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Editorial Notes.

The Ammonia Problem.

THIS was discussed at the Institution Meeting on the morning of Nov. 14, when the First and Second Reports of the Ammonia Sub-Committee were presented. The First Report—"Economies in the Recovery of Ammonia by the Indirect Process," by Mr. Hollings and Dr. Pexton—was published in the "JOURNAL" for June 12; while to-day we complete publication of the Second Report, the first part of which appeared in our Supplement last week.

Regarding the First Report, the authors show how a suitable medium for the replacement of water for ammonia washing may be obtained by fractional condensation of the virgin liquor, and explain that the replacement of water by weak ammoniacal liquor in the final washers produces no adverse effect on the effluent from the ammonia still. Emphasis is laid on the fact that efficient cooling of the gas and provision of washers of adequate capacity are subjects on which clearer understanding is needed; and in their general conclusion the authors state that the capacity of condensing and washing plant could be increased, if necessary, by 25 p.ct. with an expenditure of capital representing a charge of only from 5s. to 6s. per ton of sulphate of ammonia made, and the possible savings in many cases are considerably greater than this expenditure. That this contribution to the ammonia problem has already been of great service was indicated particularly by the remarks of Col. Carr and Mr. Henshaw (of Messrs. W. C. Holmes & Co., Ltd.). The latter suggested that it was of greater value to our industry than anything which has been published before in its history, and offered an explanation of why the kind of work carried out by Mr. Hollings and Dr. Pexton has not been done so successfully before. Mr. Thomas Glover, who spoke about efficient and inefficient washers, and expressed the hope that the Committee would not lose sight of the main object—removing the difficulties which many works are experiencing in disposing of their nitrogen products in the form of ammoniacal liquor or ammonium salts—pointed to the necessity of the complete removal of tar fog before the gas enters the ammonia washers.

The Second Report consists of four communications. The first to be presented at the meeting was that of Dr. E. W. Smith, on the subject of liquid purification of coal gas by means of ammonia. He dealt in turn with the Claus system erected at Belfast in 1886, with the investigations carried out by the author and Dr. Davidson in Birmingham from 1910-14, and with the possible application of liquid purification to-day. On all practical counts the case for its application was lost, and it was decided not to pursue the matter. Prof. Cobb followed with a review of his zinc process for the extraction of ammonia and sulphuretted hydrogen. With balanced judgment infrequently associated with inventors of systems, he said that, though the process worked, it would be unsuitable for small plant, and the succession of operations necessary would make the labour costs too heavy unless the process was operated on a considerable scale. Mr. Botley, who is Chairman of the Committee, pointed out that there is no need to lose sight of such a fascinating process simply because it appeared to be inapplicable at present or in the immediate future; and Mr. G. R. Thompson, of Leeds University, who spoke at length on the beauties of dilute solutions, urged that his intimate acquaintance with the process invalidated Prof. Cobb's claim to be a deep-dyed pessimist.

The Burkheiser Process.

THEN came Mr. Moon's summary of the Burkheiser process, which, he said, appears to contain the elements of a practical and smoothly working continuous method of gas purification and ammonia recovery. He regards it as most desirable to maintain close observation of any progress made in the system, and thinks that it would amply repay research work by those connected with Institution investigations. Mr. Parrish, however, holds out little hope for the process, unless it is simplified very materially. He has been interested in it for seventeen or eighteen years, and sees it as a desideratum surrounded by a barricade of formidable obstacles. Perhaps chief among the latter is the fact that Burkheiser salt is not ammonium sulphate, but a mixture of sulphate and sulphite which does not admit of entire conversion. And Mr. Parrish's excursions into horticulture have led to results contrary to those of Dr. Weiler, and have "proved definitely that the presence of even minute traces of ammonium sulphite is distinctly disadvantageous to the success of the plant." Dr. Parker echoed Mr. Parrish in milder strain, pointing to "an enormous amount of physico-chemical work" as a ray of hope.

Mention of the Koppers "C.A.S." process was made by Mr. Botley, and Mr. Townsend, of Colchester, referred to a system invented by Dr. Tern which is in operation at the gas-works at Engelsdorf bei Leipzig, and which, it is claimed, is making salt £4 10s. per ton cheaper than by current methods. At this stage Mr. Townsend appealed for greater general enthusiasm among the members of the Institution regarding the work undertaken by the Ammonia Sub-Committee, and the cheerful expenditure of a few hundred pounds—a figure which Mr. John Wilkinson later suggested ought to be thousands. Some slight misunderstanding of the aim of Mr. Townsend's remarks led him to assert that criticism of either the Sub-Committee or the Council was alien to his mind.

The Second Report was completed by a most valuable summary of the indirect, semi-direct, and direct processes of ammonia recovery, by Dr. Parker. The latter two methods, he concludes, are neither so flexible nor so easy to operate for the production of a salt of uniformly high quality as is the indirect process; and only if the satisfactory disposal of effluent liquor should necessitate the removal of tar fog from the gas before liquor condenses will the cost of the direct process show to advantage. In common with Hollings and Pexton, he points to the

economies to be gained in ammonia recovery by the indirect process by the modification of the systems of condensation and scrubbing so as to avoid the addition of water. As a final note, he suggests that the possibilities of replacing the indirect process by the direct process, adapted to suit the conditions in the gas industry, might be again considered when the investigations of the Liquor Effluents Research Committee of the Institution of Gas Engineers have proceeded further. Lack of time alone prevented adequate discussion of Dr. Parker's communication. No undue surprise, however, was evinced when Mr. Sensicle, as a staunch advocate of the direct process, expressed the opinion that Dr. Parker had over-emphasized the power costs of this process. Mr. Sensicle said that both capital costs and maintenance charges of the direct recovery plant are lower than those of the other systems, that direct recovery saturators can operate successfully with large fluctuations in the rates of gas production, and that the salt produced is being sold at the same market price as any other. The President undertook to set apart a short session for further discussion on Dr. Parker's communication at the annual meeting of the Institution in Leeds next year; and in the meantime the author awaits written contributions. Finally, Mr. Botley, calling attention to the terms of reference of the Ammonia Sub-Committee, made it clear that its members have no limited perception of their duties.

Effluents.

The last session of the meeting, on the afternoon of Nov. 14, was devoted to discussion of the effluents problem; and the Fourth Report of the Liquor Effluents Research Committee, with the exception of the section dealing with the activities of the Emscher Commission, which is a reprint of our translation published in the "Journal" for Aug. 21 last, concludes our final Supplement. This report contains a memorandum by Dr. Parker on processes for the removal of phenol from ammoniacal and effluent spent liquors, an account by Dr. Monkhouse of a visit to German plants, and a summary, also prepared by Dr. Monkhouse, of the treatment of spent gas liquor in admixture with sewage at Cheltenham. The Third Report, presented last June, was also discussed.

Mr. Botley, the Chairman of the Committee, explained that their researches had shown the way to reduce the higher tar acids, but, unfortunately, at the expense of an increase in phenols. He suggested that this finding was "rather unexpected," but Dr. Pexton mentioned that he had predicted this during the discussion on liquor effluents at the Carbonization Conference in Birmingham in February, 1928—see "Journal" Carbonization Conference Supplement, March 7, 1928, p. 127. He asked, among other questions, if experiments had been made to ascertain whether the benzole extraction process will remove the polyhydric phenols from vertical retort liquors to a sufficient degree to render them colourless on exposure to air, and was assured by Dr. Monkhouse that experiments on this matter are being carried out at Hinckley.

With regard to the summary of the purification work at Cheltenham, this, said Mr. Botley, shows what can actually be done at the present time in the disposal of a properly controlled effluent to the sewage system. Mr. L. E. Twycross, the Engineer and Manager of the Cheltenham Gas Company, and all concerned with the work, have arrived an an excellent and amicable solution of a problem which threatened grave difficulty, though we wonder if the situation at Cheltenham would be quite so happy if many more industrial wastes had to be treated. Mr. F. R. O'Shaughnessy, who made the report from which Dr. Monkhouse prepared his summary, having complimented the gas industry on their consideration and activity in endeavouring to relieve the burden imposed on the sewage authorities, expressed the hope that before long the "four hours' oxygen absorption" test will be relegated to the dump labelled "obsolete," and that the biochemical oxygen demand method will reign in its stead. On the question of the recovery of phenol and higher tar acids, Mr. D. W. Parkes, of Messrs. Robinson Bros., had something interesting to say, and he said it in a clear and interesting way—a manner which brought temporary relief to the strained faces of many members. He compared the space taken up by the filter beds at Foleshill with that which would be occupied by a carbon plant of the same capacity, and mentioned that he was most interested in the experiments made by Dr. Monkhouse with a view to reducing the higher tar acids, for the simple reason that he was trying to do just the opposite. Tar distillers are out for catechol via tar acids. Mr. Sensicle spoke of the advantage of the direct process from the point of view of the effluents question. We are not convinced, however, that this is an intrinsic merit of the system; plant operating conditions have something to do with the matter.

Sundry votes of thanks concluded a meeting which must have encouraged those responsible for the researches jointly undertaken by the Institution and the University of Leeds, if only because it proved that the members of the Institution are applying to great advantage the information which is being placed before them. One hundred per cent. value is to be obtained, stated Col. Carr, by making use of the valuable work carried out by the General Research Committee; incidentally, this conclusion is the result of his experience.

The Government and the Mines.

From the vague reports and rumours which come to light regarding the coal negotiations now being carried on, it is extremely difficult to follow the situation from day to day, or even from week to week. The state of affairs is a curious one indeed, when the Government is negotiating, almost bargaining, first with the miners and then with the owners in an endeavour to placate them both for a disappointment, and obtain the reluctant consent of each to a kind of middle course. It appears that the miners have consented to believe that, for the present, the Socialist Government cannot give them the full remission of working hours which was so glibly promised before the election. Having, then, persuaded them to accept half the loaf as a first instalment, the Government have been principally concerned with the owners in recent weeks. Here the difficulties are more serious.

To begin with, the coal trade has again unfortunately been made a political issue, and the Government is confessedly favourable to the miners' claims. But, having confessed that the full hour's reduction in working time would be impossible at present, they have also had to acknowledge that even a half-hour cannot be knocked off, and miners' present earnings maintained, without some compensating measure. This concession having been made to the owners' views, the owners were told to draw up a marketing scheme to cover all the various districts, and that, if they did not, an officially devised scheme would be imposed upon them. Most unwillingly as regards several of the districts, they chose the lesser of the evils, and submitted a scheme on the appointed date; and it is around this point that present "negotiations" are taking place. The Government's argument is the threat of compulsion, and the colliery owners' chief card is the knowledge that any marketing scheme would be largely dependent upon their goodwill for success, whatever measures of nominal control the Government could obtain. One probable outcome of the present bartering will be a postponement of the reducing of hours beyond the intended date of April 6, since it appears now that there will be some difficulty in getting the promised Bill through Parliament in time to allow of the three months' try-out of the marketing scheme which the Government has deemed advisable before the change takes place.

Such appears to be the situation in outline at the present time. The consumer must still wait to know what is to be his fate under the selling scheme. The man in the street is still utterly unable to grasp what is going on. But, however much he may deprecate the confusing of any industry with a political issue, however amazed he may be at the position of His Majesty's Government in the matter, he probably has a secret feeling of satisfaction that there are no direct negotiations in train between mine owners and miners. These have come to be regarded in recent years as almost certainly presaging a national calamity.

Salesmanship in its Widest Sense.

THE widespread interest shown by the Press in the first Interim Report of the Committee on Education for Salesmanship, and the unanimous approval and support given to it by the expert journals as well as the general newspapers throughout the country, must be a considerable reward to the Committee, and especially to its Chairman, for the work and thought the report represents; work and thought voluntarily given, in the words with which the report concludes, through "a desire to be of service to British industry at home and British commerce abroad." The gas industry will rejoice very particularly in this interim success of the Committee, because its Chairman is their own chief "sales manager." He, Mr. Goodenough to wit, would, we are certain, be the first to beg that there should be no shouting while his Committee are still deep in the wood, seeking the best roads to the solution of their problem, how, "by means of education, to promote "greater efficiency in the marketing of British goods "and services." But that is no reason why we should not say, with all appreciation of the difficulties yet to be faced, that the Committee have done much useful preliminary service by the publication of this interim report. In it they have reminded us all of certain basic principles which it is imperative should be—as they certainly are not—generally accepted and observed, and by it they are clearly arousing that interest among industrialists and educationists which is a vital condition precedent to the consideration later on, by these same industrialists and educationists, of the Committee's final recommendations.

The Committee, knowing the intentions of the Minister who appointed them to study "education for salesman-"ship in its widest sense," have interpreted their subject as "covering not merely the work of the commercial "traveller and of the salesman behind the counter in "the showroom or on the exhibition stand, but the whole "art of finding, catering for, and developing markets for "the products and services of our manufacturers. . . . "It embraces the study of the fundamental principles "of commerce and the planning of policy based upon "them, as well as the selection, training, and direction "of the personnel required for translating policy effec-"tively into action. . . . Education for salesmanship is "therefore education for Commerce on its creative, or-"ganizing, and executive sides; and, in Lord Eustace "Percy's words, 'covers the whole field of higher educa-"tion.'"

For the way in which the Committee have begun this great and most important task—in the performance of which they have a wonderful opportunity of service, not only in their day and to their generation, but to generations yet to come—we would refer our readers first to the extracts we print from the report on later pages of this issue, and then to the document itself, which is certainly the best value for fourpence we have met for many a long day. Here we will only stress one point—namely, the primary responsibility of the management of every business (1) to recognize the importance of efficient salesmanship; and (2) to secure and maintain "an adequate, "efficient, and high-class body of salesmen," carefully selected, thoroughly trained, given proper status, and, last but not least, sufficiently and attractively paid. Employers are reminded by the Committee that "they can-"not get a good representative, any more than they can "get a good article, unless they are prepared to pay a "good price." They are also reminded that "the initia-"tion, organization, and vigilant maintenance of the "firm's sales policy must be the primary and constant "concern of the principals." Employers who accept the latter responsibility will soon come to realize the truth and force of the earlier reminder. Recognition, not only financial but complete, of the importance of the organizers of commercial victory and of their staffs and armies, is the prime essential to such victory—indeed, to the maintenance of our existence as an industrial nation. And what is true of the nation as a whole is true of the individual industries comprised within it, and of the individual undertakings comprised within each industry. The responsibility is particular, as well as general.

The March of Progress.

PUBLIC attention is now turned upon the Government's new Road Traffic Bill, which we are told opens up a new motor era. No one is likely to urge that some such effort is not due; and should it be found to offer all possible protection to the "weaker" section of the community—"weaker," that is, when judged from the standpoint of road traffic—the Bill is assured of friends. But before it finds its way on to the Statute Book much argumentative matter will pass through the printing presses; and many old friends will once again be found wagging their hoary heads. Already we are being reminded of the fact that a slow driver is not necessarily a safe driver; while on the same page of the newspaper there is recorded a fatality to two persons who were run down at night while alighting from a tramcar at a stopping place. To us, the point about this accident is that it occurred at night. In our individual capacity, we are touched by accidents at any hour of the twenty-four; but as part of the "JOURNAL"—which has no body to be mutilated—we are concerned only with those which take place after dark. There are no statistics to furnish the percentage; but newspaper reports show these to be a not inconsiderable proportion of the whole number.

Various ways have been suggested of rendering the streets safer by night for the walker. One Coroner, it appears, has been complaining of the fact that pedestrians wearing dark clothing cannot be seen by motor drivers; and he is reported to have added that "it seems as if the pedestrian either has to keep a sharper look-out or imitate the policeman and wear a white cape at night. Pedestrians carrying something white, such as a newspaper, would be much more easily seen." Is it possible that one day an industry may grow up for the supply of something of the nature of pillow cases, which can be slipped on over the clothes of those who may be "detained late at the office," and others unfortunate enough to have to walk the streets at night? We are, indeed, half inclined to regret the fact that the colour of the wrapper of the "JOURNAL" renders it unsuitable as an aid to motorists in this connection. However, this is by the way. In all seriousness we welcome any suggestion that may tend in the direction of greater safety; but we believe a better plan than the one proposed by the Coroner referred to is to be found in adequate street lighting. This seems to be the alternative to (as a last resource) forbidding pedestrians to be abroad after dark—to the revival, that is, of the principle of the curfew, directed against that portion of the community which may be either unable or unwilling to travel on wheels.

It has been announced by the Daily Press that the Cabinet have decided to take in hand the problem of the ever-growing number of street accidents in London, and that Mr. Herbert Morrison, Minister of Transport, is to call a representative conference of London authorities on Jan. 14. The principal matters for consideration will include the setting-up of an authority to investigate London street accidents, and proposals for reducing the number of accidents. In London street accidents during the first six months of this year no fewer than 615 persons were killed and 25,214 injured. No doubt the importance of adequate street lighting will be fully considered when the time for this conference arrives.

Adequate Street Lighting.

THAT this question of adequate street lighting is even now in the public eye is shown by the correspondence columns of "The Times." There, one day last week, Rear-Admiral Barry Domvile asked whether it is feasible, in our large cities and towns, to light the streets after dark to such an extent as to enable vehicles of all descriptions to be exempt from using their own lights when within the metropolitan or urban areas. We believe—and existing installations bear us out in this—that modern gas lighting is pre-eminently suited to meet all requirements. Where, as that correspondent says, "the present systems of town lighting leave much to be desired," the cause is only too frequently to be found in the cost. Good lighting costs money; but how often is expenditure

upon it begrudged. The appalling death and mutilation roll must be checked in one way or another. Even the "jay-walker" cannot be regarded as an outlaw. See how thoroughly gas can fulfil the needs laid down by the correspondent in question: "Intensity of illumination is "not required, as this only increases contrast or shadow; "what is needed is a gentle diffused light, screened and "sited so as to eliminate the shadows, which at present "are a source of danger and lead to the use of powerful "headlights by a cautious driver, even in some of the "streets in the West End of London." The gas industry is ever mindful of the public interest; and we appeal to all engaged in it to spare no effort to secure more general recognition of the need for adequate street lighting.

Valuable Advice.

ALREADY Mr. W. J. A. Butterfield has followed Admiral Domvile's letter in "The Times" by some valuable advice regarding what to do and (equally important) what to avoid. Speaking first of directional street lighting, Mr. Butterfield remarks that this "may, in itself, be nearly "as harmful and confusing to the driver and walker as "is the car lamp. The surface intensity or brilliancy of "electric lamps with clear gas bulbs is so great that they "should never be used in streets in positions or at levels "at which their beams strike full into the eyes of those ap-"proaching them. Still less should mirrors be used to "direct these beams in the line of the path and carriage-"ways. The reflection in a mirror of an unobscured "filament is most disturbing to the eyes. In this respect, "the Borough of Croydon in its street lamps has set a bad "example which unfortunately has been followed recently "by Beckenham. Clear glass bulbs should be banned in "public lighting. There are also types of high-power "electric lamps which should never be placed less than "20 ft. above the roadway."

On the other hand, Mr. Butterfield points out that "the "gas mantle affords a relatively soft light, having natur-"ally good diffusive powers, and consequently it is much "appreciated by drivers. One has only to compare the "promenades and streets of Torquay, which are lighted by "electricity, with those of Weston-super-Mare, which are "lighted by gas, or the electric lighting of Taunton with "the gas lighting of Bridgwater, to understand why both "motorist and the walker are more at ease after nightfall "in Weston or Bridgwater than in Torquay or Taunton. "Even the latest example of electric lighting on the Vic-"toria Embankment presents little improvement on the "twenty-year-old gas lighting of Whitehall, Regent "Street, and Victoria Street; and there is little doubt "that the latest developments of public lighting by gas "would give even more efficient results. If they were "adopted generally, lights on vehicles might be dispensed "with in urban areas."

In these remarks, Mr. Butterfield, who speaks with authority on the subject, fully bears out our contention that modern gas lighting is pre-eminently suited to meet all requirements in this connection.

Benzole Recovery.

WE are glad to see that the subject of benzole recovery from gas is being vigorously re-attacked, because we think that it was shelved rather too casually—even though its shelving may have been necessary temporarily—and that changes in the practice of the industry have lent a new complexion to the economics of the process. In the days of candle-power standards, extraction of benzole from the gas was not to be regarded lightly; but to-day many arguments formerly advanced against extraction do not hold. For example, the more or less general removal of naphthalene at the works has quashed one difficulty, and the suggested deterioration of meters has proved only a theoretical bogey.

There appear to be three main phases of the subject. Lowering the calorific value of straight coal gas; the relative value of a therm in benzole and a therm in gas; and the possible effect on the coke market. Let us take them *seriatim*. Very few undertakings are supplying straight coal gas, which has, or ought to have, a calorific value in the neighbourhood of 560 B.Th.U. per c.ft. Dilution, by "steaming," water gas admixture, or means less satisfactory, is the order of the day. Hence a drop of 25 B.Th.U. per c.ft. produced by the extraction of benzole is in itself of no consequence.

The second point—the relative value of a therm in benzole and a therm in gas—should be considered broadly, and from at least two angles. First, the question must be asked—and it must be answered satisfactorily—whether existing plant would not in many cases be worked more economically with greater regularity in the throughput of coal. This, of course, applies particularly to summer conditions. Secondly, is an extra consumer equal to 5 p.ct. of the output—a consumer, moreover, requiring no distribution and maintenance costs—desirable? On the answer to these two questions depends the basis on which the cost comparison can be made. Obviously, it is wrong to debit benzole with the cost of a gaseous therm for which there is no immediate sale; obviously, it is not good reasoning to charge a large consumer such as this the price at which gas is supplied to the ordinary domestic consumer taking a few thousand cubic feet per quarter. No true comparison can result unless there is adequate allowance for these factors. The third consideration complicates the situation, but the difficulty it imposes should not be insuperable. More coal for the manufacture of straight coal gas means more coke. The effect on market conditions must have a bearing on the cost of benzole recovery; that is one of the reasons why we have always been so little impressed with the idea of a standard calorific value of gas supply throughout the country. Here again, what may seem an impassable barrier may be dissolved into thin air by slight modification of the declared calorific value.

The foregoing remarks are evoked by the Presidential Address of Mr. F. Firth, Chief Chemist to the Leeds Gas Department, before the Yorkshire Junior Gas Association, which was published in part in last week's "JOURNAL," and by the paper by Mr. F. Nicholls, Senior Chemist to the Newcastle-upon-Tyne and Gateshead Gas Company, before the North of England Gas Managers' Association on Saturday last. The latter contribution will be found on later pages of our issue to-day. Particularly in view of the possible developments in the near future in the process of benzole recovery, it is difficult to disagree with their idea that the subject should be reconsidered as an extension of gas-works activities.

Dirt and Clinker.

AT the same meeting of the North of England Gas Managers' Association, Mr. W. E. Plevin, of the Blackpool Gas-Works, dealt with "Dirt in Coal: Its Influence on Carbonization." Recently the author carried out a most interesting investigation into the true nature of the dirt removed from coal by a dry cleaning plant owned by the Durham Colliery Company, and his findings are set out clearly and concisely in to-day's "JOURNAL." We call attention to what our friends across the Atlantic would term the "high lights" of his paper: Only about 75 p.ct. of the dirt present in coal would manifest itself in the ash figure; dirt has a very high sulphur content compared with the normal figure for a good gas coal; dirt results in the production of large quantities of breeze the disposal of which is difficult; dirt contributes to the gas yield (*circa* 16 therms per ton), and therefore it is wrong to calculate that, in cleaning a coal, entirely inert matter is removed. In spite of the last-named characteristic of dirt, however, we feel that its presence in a gas retort is an anachronism.

We have spoken of Mr. Firth's address. A further section, on the subject of producer gas practice, is published in our columns to-day, and it makes entertaining reading. He emphasizes the important part played by clinker in the open natural-draught furnace, for it determines the velocity at which the air enters the fuel bed. He outlines the cycle of events between clinkering periods. Immediately after clinkering, the primary air has free access to all parts of the fuel bed; the velocity is low, and the carbon dioxide content of the gas high. Clinker forms, and virtually restricts, the area of the bed,

causing the air to pass through the interstices of the clinker, which act as nozzles, at higher velocity. The local temperature is raised, and the carbon dioxide content of the gas is low. With limited grate area, it is necessary to prick the fire at frequent intervals; hence the desirability of having ample grate area. He advances his theory to indicate that the design of producers—from the gas producing, not the structural, point of view—is imperfect; and he suggests that it might be advantageous to limit to a minimum the removal of clinker from the sides and lintel of the furnace. Where a wide producer is in operation, he submits, this can be practised, when, in addition to the better quality of the gas, there is a distinct gain in the longer life of the furnace linings.

Suggested Subway Conference.

On the vexed question of subways, the General Purposes Committee of the London County Council are putting forward a proposal for a conference of the authorities and bodies interested in the question of the provision of subways for mains in streets—namely, those having statutory powers to lay mains, those having control of streets, and those interested in traffic. The Home Secretary had asked for the Council's observations on a suggestion by the Coroner for the City of London that a Government inquiry should be held; and the Highways Committee had suggested that the inquiry should take the form of a Royal Commission. The General Purposes Committee, however, express the view that, having regard to the many interests and authorities involved, the whole question should first be investigated by those most intimately concerned and possessing practical experience of the problems to be solved, and that, on the whole, the course of convening a conference is the best to adopt. This conference, after probing the problems, would be in a position to indicate whether further investigation is necessary, and whether it should take the form of a Government inquiry—by a Royal Commission or otherwise.

Illumination.

From a note appearing on another page, it will be seen that the next International Illumination Congress will take place in Great Britain in 1931. The similar congress held in the United States last year was marked by great enthusiasm; and the arrangements made with the object of illustrating progress in lighting in that country were on an unprecedented scale. In 1931 this country will have an opportunity of showing experts from all parts of the world what we can do in the lighting field, and of taking a prominent part in the development of illuminating engineering. Preliminary arrangements for this congress are already well advanced.

Gas Cokes for the Open Fire.

On Nov. 15, Mr. H. J. Hodsman, of the Leeds University Fuel Department, read a paper dealing with the correlation of the behaviour of carbonized fuels in the open grate with their properties as ascertainable in the laboratory. His contribution—an abstract of which is published in later columns of the "JOURNAL" to-day—was to the proceedings of the South Wales Section of the Society of Chemical Industry, and is based on the work of Mr. J. H. Dyde, now of the Plymouth and Stonehouse Gas Company. Comparing various types of smokeless fuels, Mr. Hodsman says that, from the point of view of radiant efficiency, the gas cokes taken for the experiments display the best performance. "In regard to flexibility in use, they are less favourably placed. Here the low-temperature cokes, with consequently lower ignition temperatures, show to advantage." The growing adoption of gas ignition, however, should eliminate this drawback to high-temperature cokes.

OBITUARY.

The death has occurred, at the age of 66, of Mr. ARTHUR W. BAMFORD, who for the past fifteen years was Secretary to the Walton-on-Thames and Weybridge Gas Company. Though in indifferent health for some considerable time, Mr. Bamford was absent from business for but three weeks prior to his death.

PERSONAL.

The many friends of Mr. C. VALON BENNETT, of Rochester, will learn with much regret that he is suffering from pleurisy. On inquiry yesterday, we were glad to find that there was some slight improvement in his condition.

The Manchester Corporation Gas Committee have recommended the City Council to sanction the appointment as Chief Engineer of the Gas Department of Mr. A. L. HOLTON, the Manager of the Bradford Road Gas-Works, at a salary of £1500 a year. The previous decision of the Committee, it will be recalled, recommending the appointment of Mr. Holton at a salary of £1750 a year was referred back to them by the Council for reconsideration on the ground that Mr. Holton was one of the applicants for the position when it was originally advertised at a salary of £1500.

Mr. C. G. BARRETT, Assistant Engineer and Manager of the Hartlepool Gas and Water Company, who has been appointed Engineer, Manager, and Secretary of the gas and water undertaking of the Devizes Corporation, was articled to the Hartlepool Gas and Water Company under the late Mr. Thomas Bower, upon whose death he was appointed Assistant Manager. He is a Past-President of the Auxiliary Section of the North of England Gas Managers' Association.

Mr. L. H. SENSICLE, B.Sc., F.I.C., who for the past two years has been Chief Chemist to the Newcastle-upon-Tyne and Gateshead Gas Company, has accepted an appointment with Gas Chambers and Coke Ovens, Ltd., Artillery House, Artillery Row, London, S.W. 1, and will be taking up his duties with them at the beginning of the New Year.

FORTHCOMING ENGAGEMENTS.

Dec. 7.—WESTERN JUNIOR GAS ASSOCIATION.—Visit in the morning to the works of the Horstmann Gear Company, Bath. In the afternoon adjournment will be made to the Offices of the Bath Gas Company, where a paper will be read by Mr. H. W. Willmer on "Gas Sales Policy."

Dec. 7.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Visit to Lady Victoria Pit and Gas-Works, Newtongrange.

Dec. 7.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Meeting in Glasgow.

Dec. 7.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Oswald Street Works, Burnley. Paper by Mr. N. Partington (Oldham) on "Coal Testing Problems."

Dec. 10.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Committee.

Dec. 10.—FEDERATION OF GAS EMPLOYERS.—Meeting of the Central Committee.

Dec. 11.—INSTITUTION OF ENGINEERS-IN-CHARGE.—Meeting at the St. Bride Institute, Fleet Street, E.C. 4, at 7.30. Paper by Mr. E. B. Tait on "Pumps and Their Selection for Various Duties."

Dec. 12.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1.

Dec. 12.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting in Birmingham. Paper by Mr. G. G. Buttery on "The Uses of Portable Calorimeter in Retort House."

Dec. 12.—"B.C.G.A." WEST RIDING OF YORKSHIRE DISTRICT CONFERENCE.—Town Hall, Huddersfield, at 11 a.m.

Dec. 13.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute, Vincent Square, S.W. 1, 7.30 p.m. Paper by Mr. J. L. Hodgson on "The Accurate Measurement of Gas Flows by other than Volumetric Methods."

Dec. 14.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting in Leeds. Paper by Mr. W. E. Stephenson (Southbank) on "Electrical Plant in Gas-Works."

Dec. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council Meeting in the afternoon.

Dec. 18.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to Messrs. Stewarts & Lloyd's Tube Works.

"B.C.G.A." West Riding Conference.—A West Riding of Yorkshire District Conference of the British Commercial Gas Association has been arranged to take place in the Council Chamber, Town Hall, Huddersfield, on Thursday, Dec. 12, under the Presidency of Alderman R. Mitchell, J.P., Chairman of the Huddersfield Gas Committee. The morning session will open at 11 a.m., and will be occupied by a discussion on "Service to the Consumer," to be opened by Mr. H. Singleton, Engineer and Manager to the Huddersfield Gas Department. After luncheon, which will be at the invitation of the Huddersfield Gas Committee, there will be a public conference on "Air Pollution and Public Health," to be introduced by an address by Dr. S. G. Moore, Medical Officer of Health, Huddersfield. In the evening, Dr. C. W. Saleeby will lecture on "Sunlight and Health."

COMBUSTION OF CARBONIZED FUELS IN THE OPEN GRATE.

By H. J. HODSMAN, M.B.E., M.Sc., F.I.C., of the Fuel Department of the Leeds University.

[Abstract of paper before the South Wales Section of the Society of Chemical Industry, Nov. 8.]

The lecture dealt with the correlation of the behaviour of carbonized fuels in open grates with their properties as ascertainable in the laboratory, and was based on the work of Mr. J. H. Dyde, M.Sc., now of the Plymouth and Stonehouse Gas Company.

Open fires, said Mr. Hodsman, heat mainly by direct radiation of heat. The rate at which this occurs is jointly dependent on three factors, the area radiating A, its emissivity *e*, and its temperature T—*i.e.*, as the product of $e\,A\,T^4$. The area factor is influenced by grate design, shallow fires giving a reduced output, and is greatly affected by the geometrical form of the fuel, for it is the glowing cavities which make the greatest contribution. Fuels of a dense and compact character or of regular geometrical form tend to pack closely, and so do not readily develop large cavities. Such fuels are anthracite, some bituminous coals, briquettes, and cokes made by processes in which swelling is prevented during carbonization. Cokes made of blends of caking and non-caking coal often take this character. On the other hand, cokes of a spongy, angular form, which pack badly, tend to give high outputs of radiation—viz., the cokes made in continuous vertical gas retorts. These properties are, however, disadvantageous as far as transport and storage are concerned.

LOW-TEMPERATURE AND HIGH-TEMPERATURE FUELS.

The emissivity factor is influenced by the presence or absence of flame, which has a low radiating power as compared with solid fuel. In so far as the fuel burns as flame above the fuel bed, its output of radiant heat will be diminished. For this reason low-temperature cokes and coals containing volatile matter are less effective radiators than high-temperature cokes. Highly reactive fuels producing, by the reduction of carbon dioxide in the fuel bed, carbon monoxide, which burns as flame above the fire, are found to give a reduced output of radiation.

The production of CO in the fuel bed also tends to diminish the output of radiation by lowering the temperature of the glowing fuel. Only about one-third of the potential heat of combustion of the carbon gasified to carbon monoxide is developed in the fire, which either fails to attain a high temperature or does so at the cost of a high fuel consumption. Moisture chills the fuel and lowers its efficiency. This is specially open to objection in the early stages of lighting a fire.

The presence of much ash has obvious disadvantages. Contrary to anticipation, high ash content does not reduce the thermal efficiency of the fire as much as might be expected. The output of heat is reduced, but roughly in proportion to the calorific value, so that the percentage radiant efficiency is not greatly diminished. The ash has the objectionable effect of reducing the capacity of the appliance.

From the point of view of radiant efficiency, the gas cokes display the best performance. In regard to flexibility in use, they are less favourably placed. Here the low-temperature cokes, with consequently lower ignition temperatures, show to advantage, which is shared by cokes made from blends of caking and non-caking coal.

The work indicates that the radiant efficiency of fuels ranges from below 20 to about 30 p.ct. where the whole output of heat is measured from the combustion of 12 lbs. of fuel from lighting to dying down. The more usual method of testing fuel appliances is to determine the performance only after a steady condition is attained. In such circumstances the efficiency of the fuel may rise appreciably above 30 p.ct., and to figures which should justify a much greater use of such fuels if these facts were generally realized.

Taking all the factors into consideration, it is concluded that some of the desirable properties of solid fuels are mutually incompatible, and that the ideal cannot exist. In practice a compromise must be accepted.

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

BUSINESS continued on a restricted scale last week. Adverse developments arising out of the previous week's settlement proved to be unfounded, but the Chancellor of the Exchequer's remarks, which appeared to indicate unpleasant possibilities in the next Budget, rather discounted improvements. Despite the quiet conditions, the tone of the whole was steadier than of late, and in some markets there were moderate improvements in quotations. Leading International specialities were favoured in this connection, and hopes were entertained that Wall Street, which opened this week with full-time dealings, would show a better tendency.

The Gas Market was dull and uninteresting, and transactions were less than is usual. We cannot help thinking that the absence of available stock is the main cause for the depression; and this is illustrated by the fact that new issues are speedily absorbed at prices above the market quotation. The recent issue of the Uxbridge Company is an instance of this; and it is expected that the issue of the Croydon Company's maximum stock to consumers and employees at £85 p.ct., as compared with the average quotation at the date of the announcement, £79½ p.ct., will be equally successful. As will be noticed from the list, the stock has since been marked up 3 points, which is doubtless due to the issue at the higher price.

An announcement of interest is the increase in the dividend from 5 to 6 p.ct. of the Power Gas Corporation, but it is not known whether the improvement is due to the original business or to the various specialities produced by this concern.

The following transactions were recorded during the week:

MONDAY.—Bournemouth "B" 12½, Commercial 91, 92, 93, European 14, 14¼, Gas Light and Coke 18s., 18s. 2¼d., 18s. 3d., 18s. 4½d., 3½ p.ct. 60½, 61, 61⅛, 4 p.ct. pref. 74⅞, 3 p.ct. deb. 57, 57½, 5 p.ct. deb. 99⅛, 99½, Imperial Continental 335, 337, 338, 339, 344, 345, 348, Liverpool 7 p.ct. pref. 100, Primitiva 4 p.ct. cons. deb. 80½, South Metropolitan 99⅜, 100, 100¼, 100½, 101, 6 p.ct. pref. 107½. Supplementary prices, Liverpool 5 p.ct. 92½.

TUESDAY.—Bournemouth "B" 12½, Commercial 3 p.ct. deb. 55, European 13⅞, Gas Light and Coke 18s., 18s. 3d., 3½ p.ct. 61, 4 p.ct. pref. 74, 75, 5 p.ct. deb. 98⅜, 99¼, Imperial Continental 333, 335, 336, 340, Primitiva 4 p.ct. cons. deb. 81, Sheffield 104⅜, South African 4⅞, 5, South Metropolitan 100¼, 100½, 100⅜, South Suburban 5 p.ct. 102, Wandsworth "C" 96, new ord. 96. Supplementary prices, East Surrey 5½ p.ct. pref. 92.

WEDNESDAY.—Brighton and Hove 6 p.ct. 115, Croydon sliding-scale 105, European 13, 13⅜, Gas Light and Coke 18s. 3d., 18s. 4½d., Imperial Continental 333, 337½, 338, Liverpool 7 p.ct. pref. 99, 99¼, 99½, Newcastle 4 p.ct. pref. 72⅛, 72¼, South Metropolitan 100¼, 100¾, 101, Wandsworth "C" 96, new ord. 96. Supplementary prices, Barnet 4 p.ct. deb. 73, Brighton and Hove 4 p.ct. deb. 73, East Surrey 7½ p.ct. deb. 102½, Liverpool 5 p.ct. 92½.

THURSDAY.—Croydon sliding-scale 106, European 13, 13¼, 13½, Gas Light and Coke 18s., 18s. 1½d., 18s. 3d., 4 p.ct. pref. 74¼, 5 p.ct. deb. 99¼, 99½, Imperial Continental 326, 327, 330, 332, Oriental 112, 112½, South Metropolitan 99⅜, 100, 100¼, 100½, 100⅜, 101, Wandsworth new 96. Supplementary prices, Gravesend and Milton cons. 73.

FRIDAY.—Commercial 91½, Croydon sliding-scale 106, European 12⅛, 12½, 12⅞, 13⅛, Gas Light and Coke 18s., 18s. 2¼d., 3½ p.ct. max. 62, 4 p.ct. pref. 75, 5 p.ct. deb. 99½, Imperial Continental 328, 329, Liverpool 7 p.ct. pref. 100½. Supplementary prices, East Surrey 6 p.ct. pref. 96½.

At the week-end, despite the close of the month requirements, there was less money stringency in Lombard Street. The highest rate paid for fresh accommodation was 5 p.ct.; 4¾ p.ct. was mostly paid, but balances were available later at 4½ p.ct., with old loans renewable at the lowest figure. The average Treasury Bill rate was £4 14s. 10d. p.ct., which, though less by 1s. 10d. p.ct. than the previous week, was not so low as anticipated earlier in the day.

Of the Foreign Exchanges, the dollar advanced to 4.87⅜; French francs were higher at 123.85½; and German marks at 20.38¼. Wild fluctuations occurred in pesetas, which closed at 35.27; Belgas remained at 34.86¾; Dutch florins at 12.09¼, and Italian lire at 93.18.

Silver was firmer at 22 7/16d. per oz.; while Gold remained at the nominal price of 84s. 11½d. per oz.

The Bank Rate is 5½ p.ct., to which it was reduced from 6 p.ct. on Nov. 21. The Banks' deposit rate is 3½ p.ct., and the deposit rates of the Discount Houses are 3½ p.ct. at call and 3¾ p.ct. at notice.

KOPPERS "C.A.S." PROCESS.

For the Removal of Ammonia, Hydrogen Sulphide, and Cyanogen Compounds from Coke Oven Gases, with the Recovery of Ammonium Sulphate and Sulphur.

We have received through Mr. Thomas Hardie, Chief Engineer of the Gas Light and Coke Company, the following contribution by Dr. Heinrich Koppers, of Germany, to the recent discussion on Ammonia Recovery by the Institution of Gas Engineers.

HISTORICAL.

The idea of using the H_2S contained in coke oven gases for the production of ammonium sulphate is quite old. The first worker in this field appears to have been Laming, who worked on these lines in the middle of the last century without making any definite proposals. Laming worked, on the one hand, on the well-known dry cleaning process with iron oxides, and, on the other hand, endeavoured to remove hydrogen sulphide by the agency of ammonia liquor and subsequently recovering hydrogen sulphide in concentrated form by distillation. A number of chemists have experimented with a view to developing the cleaning of gas by wet processes, all having used some compound of iron or similar metal, but without success.

At the beginning of this century, two new methods were tried. The first of these was that of Burkheiser, who endeavoured to remove the hydrogen sulphide from the gas by a dry cleaning mass, containing iron, this mass being revivified by roasting. During the roasting operation the sulphur is transformed into sulphurous acid (SO_2), and partly into sulphuric acid (SO_3). Both of these oxides are used to make ammonium salts with the ammonia contained in the gas. The salt so obtained consisted in the main of ammonium sulphite $(NH_4)_2SO_3$, and contained besides quite a large amount of ammonium sulphate.

It should be mentioned at this point that a similar process has been worked out by Dr. Baer In this process the hydrogen sulphide in the gas is transformed catalytically with the addition of oxygen into sulphurous acid (SO_2). This also combines with the ammonia, and similar products result as in the above-described dry process of Burkheiser.

Later, Burkheiser developed his system in the wet form. According to this process the hydrogen sulphide is removed from the gas by means of an aqueous suspension of iron hydroxide, which is transformed into iron sulphide (FeS). This is again oxidized by air into hydroxide $Fe(OH)_3$ and sulphur. This sulphur is recovered by treating the spent washing liquor with ammonium sulphide $(NH_4)_2S$. The sulphur is thereby converted into polysulphides $(NH_4)_2S_x$. This solution is separated mechanically from the iron sulphide, and the ammonium sulphide and sulphur are recovered by distillation. The sulphur is burned to SO_2 and the ammonium sulphite is produced by reaction of this SO_2 with the ammonia contained in the gas exactly as in the dry process.

Another method of wet purification whereby ammonium sulphate is recovered in the place of ammonium sulphite was worked out by the English Chemist, Mariott, in 1876, which is described in the English Patent 39 of the same year. Mariott used SO_2 for the regeneration of his spent washing liquor. The combined action of ammonia, hydrogen sulphide, and sulphurous acid results in solutions containing ammonium thiosulphate $(NH_4)_2S_2O_3$ and the ammonium polythionate $(NH_4)_2S_xO_6$. These salts are transformed into ammonium sulphate by treatment with sulphuric acid, where, at the same time, sulphur and sulphurous acid are obtained. The process has the disadvantage that, by the addition of sulphuric acid, more sulphur is brought into the system than is necessary for the production of sulphate, and thereby greater quantities of sulphur and sulphurous acid are produced, the latter of which cannot be utilized without further treatment.

A theoretically correct solution of the problem was devised by Feld. First he tried in his process to work with a solution containing iron. His washing liquor contained iron thiosulphate (FeS_2O_3) besides iron polythionates (FeS_xO_6). These compounds react with ammonia and hydrogen sulphide to form iron sulphide and ammonium thiosulphate, the iron being reconverted by SO_2 into FeS_2O_3 and FeS_xO_6. The ammonium thiosulphate in solution was partly transformed into polythionate by addition of sulphurous acid, and this mixture was converted by heating into ammonium sulphate and sulphur. The sulphur was burned and the SO_2 used again in the process.

Feld soon left the metal-thionate process and used ammonium salts only. His washing liquor contained ammonium polythionates which absorbed the ammonia and hydrogen sulphide from the gas and produced ammonium thiosulphate and sulphur. The ammonium thiosulphate was reconverted with the sulphurous acid into polythionates, and a part of this solution was transformed by heating, as described before, into ammonium sulphate and sulphur.

Both processes described above were unsuccessful technically. Feld did not succeed in freeing the gas from hydrogen sulphide; neither could he work out the manufacture of ammonium sulphate, as he could not find a material in which to operate his process which was not subject to severe corrosion.

THE KOPPERS "C.A.S." PROCESS.

The "C.A.S." process is of the semi-direct type. The gas is cooled in the usual way, and the liquor produced is concentrated by distillation to contain 10 to 12 p.ct. of NH_3. The concentrated ammonia liquor is passed back into the washing process at a certain place.

In the washing process the cyanogen compounds are first absorbed by washing the gases in a common hurdle scrubber with the ammonia liquor containing sulphur, ammonium thiocyanite being produced during this operation.

In three subsequent hurdle scrubbers the ammonia and the hydrogen sulphide are extracted from the gases, the hydrogen sulphide being completely removed. The concentrated ammonia liquor is returned to the process in these scrubbers at suitable points. The traces of ammonia left in the gas are removed by washing in an end scrubber with the acid, freshly-regenerated solution.

The washing liquor consists in the main of a solution of iron thiosulphate with a small quantity of iron polythionates in which a certain amount of iron hydroxide is suspended. The dissolved iron compounds in this liquid absorb ammonia and hydrogen sulphide in the proportion of $2NH_3 : 1H_2S$, forming iron sulphide (FeS) and ammonium thiosulphate. The excess of hydrogen sulphide over this amount is absorbed by iron hydroxide, whereby iron sulphide together with a little sulphur is produced.

The spent washing liquor, which consists of ammonium thiosulphate, to which the ammonium thiocyanate formed in the first washer has been added, together with iron sulphide and sulphur produced as described above, is divided into three parts.

The first part is treated with sulphurous acid. Iron sulphide is dissolved, and iron thiosulphate and a little iron polythionate are formed; also a small amount of sulphur is liberated. The solution is then filtered to recover the free sulphur contained therein; and this is again used in the washers.

The second portion of the liquid is treated with air and is converted into iron hydroxide and sulphur, and after this treatment returns to the washers. The sulphur that is formed in the washers, on mixing this liquid with the iron thiosulphate solution obtained by the revivification of the first portion of the liquid by SO_2, is later recovered by the filtration operation previously described.

The third part of the spent washing liquor is allowed to settle in a sedimentation plant; the iron sulphide and sulphur settle to the bottom, below the liquid containing dissolved ammonium salts. The iron sulphide is added to the first portion of the liquor for treatment by sulphurous acid, whereby the iron is returned to the washing process. The supernatant solution of ammonium salts, free from iron, which contains ammonia, cyanogen compounds, and hydrogen sulphide absorbed from the gas, is also treated by sulphurous acid, whereby it is partially transformed into ammonium polythionate. It is then heated under pressure to 180° and is converted into ammonium sulphate and sulphur. By selecting proper working conditions, it is possible also to transform the ammonium thiocyanate into ammonium sulphate. The only waste product is carbon dioxide derived from the carbon in the cyanogen compounds.

By the heat treatment under pressure, a solution of 50 p.ct. ammonium sulphate is formed, from which the salt is recovered in vacuum evaporators. The salt is neutral and is chemically pure.

The sulphur produced in this process is used for the production of sulphur dioxide, as also is the sulphur obtained by filtration. Any sulphur in excess of the proportion of $2NH_3 : 1H_2S$ can be sold in a comparatively pure form.

The difficulties which were encountered in the Feld process are all avoided in the Koppers "C.A.S." process:

(1) By regulation of the composition of the washing liquor and by the manner of revivification, the process can be adjusted to deal with a gas containing ammonia and hydrogen sulphide in any proportion. The gas can be completely freed from hydrogen sulphide.

(2) The problem of the materials to be used in the construction of the reaction vessels has been completely solved. In contrast with the Feld process using ammonium salt solution, the washing liquor used in the "C.A.S." process hardly attacks the iron, and therefore it is not necessary to use a protective coating in the washers. Work-

ing in conjunction with the firm of Krupp, a certain metal alloy has been found which will stand the action of polythionate solution at temperatures of 200° C. and over. It was thus made possible to work the process of sulphate manufacture in a technically perfect manner, and moreover to transform the ammonium thiocyanate into ammonium sulphate. This latter achievement ensures a yield of ammonium sulphate at least 10 p.ct. higher than by the ordinary processes.

The economical advantages of the "C.A.S." process may be summarized thus:

(*a*) 1 ton of sulphuric acid of 144° Tw. is saved per ton of sulphate made.

(*b*) There is an additional yield of 10 p.ct. of ammonium sulphate.

(*c*) The high cost of the dry gas purification is saved. For conditions in Germany a saving of at least 30 reichmarks per ton of ammonium sulphate by this item alone.

(*d*) The excess sulphur can be sold for commercial purposes.

(*e*) The process works in a semi-direct manner, and the cost of steam is very low. It has also the advantages of the Koppers semi-direct process. The cost of operation throughout the year is very low, and not higher than those plants built on the semi-direct lines including the oxide purification.

ON THE ELECTRICAL SIDE.

Manchester Generating Station Nuisance Case.

By a decision of the House of Lords, the case has been finally disposed of in which the question was whether the Manchester Corporation were liable for a nuisance caused by the emission of sulphur fumes from their electrical power station at Barton-upon-Irwell, and it has been disposed of in a way which, the "Manchester Guardian" comments, "will be hailed with relief wherever in this country the progress of the 'grid' threatens the erection of giant generating stations." It may be remembered that the claim was for damages and for an injunction to restrain the Corporation from causing to issue from their electrical power station offensive, poisonous, unwholesome, and deleterious smoke, fumes, gases, and noxious matter in such a manner that they were spread and diffused over Mr. Farnworth's farmhouse, buildings, and land. The Corporation admitted a substantial nuisance, but contended that by virtue of their Act of 1914 they were entitled to erect and use the generating staion, even though they could not do so without causing a nuisance to Mr. Farnworth. The first Court decided for the Corporation; but the Court of Appeal, by a majority, reversed this judgment. The Corporation appealed to the House of Lords, but without success; the appeal being unanimously dismissed.

In the House of Lords, the first judgment was by Lord Dunedin, who said it had been clearly proved that those responsible for the design and working of the station never considered, when designing, the effect it would have on the neighbourhood, and never asked or obtained outside advice from those skilled in such matters. He drew attention to the gravity of the nuisance caused by the pollution of the air, through the enormous output, and remarked that the serious character of the trouble naturally made one reflect on the magnitude of the nuisance which would be caused by stations far bigger than this one.

His Lordship continued his judgment as follows: "When Parliament has authorized a certain thing to be made or done in a certain place, there can be no action for nuisance caused by the making or doing of that thing if the nuisance is the inevitable result of the making or doing so authorized. The onus of proving that the result is inevitable is on those who wish to escape liability for nuisance; but the criterion of inevitability is not what is theoretically possible, but what is possible according to the state of scientific knowledge at the time, having also in view a certain common-sense appreciation, which cannot be rigidly defined, of practical feasibility in view of situation and of expense. In this case we can hold that by their callous indifference in planning the construction of the station to all but its own efficiency, the defendants have not discharged the onus incumbent on them. . . . Had the defendants been under a nuisance clause, they would have really exerted themselves to find a remedy. As it is, they are more than likely to sit with their hands folded; and other municipalities, seeing the law, will avoid Provisional Orders when arranging for a generating station outside their own boundaries, and trust to getting authority in an Omnibus Act as here, which, according to decision, will not be a Special Act which would contain a nuisance clause along with it. It is for these reasons that I do hope this case may attract public attention, for assuredly the dangers it discloses are a matter of great importance to thousands of people."

The Case of the Battersea Station.

It is very opportune that the delivery of the above judgment should coincide with the issue of a Government paper on the treatment of sulphur fumes in conection with the working of the proposed Battersea power station. This comprises a report by the advisers of the London Power Company regarding experiments made to test the efficiency and practicability of a scheme to remove sulphur gases by washing with water; while there is also an interim report made by the Committee presided over by the Government Chemist who were appointed to keep in touch with the investigations. The Committee state that they have examined the report of the London Power Company; and they consider the work so far reported indicates that, by the use of water sprays in the experimental apparatus, it is possible to eliminate from the gases of combustion nearly the whole of the sulphur gases present.

The Committee have also inspected the experimental arrangements while in operation, when neither acid taste nor objectionable odour could be detected by breathing the undiluted treated gases coming from the exit flue. The analytical results as regards acidity of ingoing and outgoing gases during an experimental run were checked; and the absorption of about 95 p.ct. of the sulphur acids in the flue gases was confirmed. However, the Committee do not forget that all this is experimental; and while they consider that it has afforded results that are promising, they recognize that there are features in the experimental apparatus and process which are still obscure. Therefore, while they see no inherent reason why similar results should not be obtained from the larger experimental plant now being erected on the lines of a projected installation at Battersea, they prefer to await the results afforded by this larger experiment. They regard it as necessary that a more definite explanation of the mechanism of the oxidation of sulphurous to sulphuric acid in the experimental process should be forthcoming before they can report on the practicability of the process.

Further Considerations.

Further discussing the matter, the Committee say that in connection with the Battersea power station very large quantities of condenser water are to be used—as much as 500 tons, they were informed, for every ton of coal burned. A portion only of this quantity should be required for washing the gases. They have ascertained that the alkalinity of Thames tidal water near Battersea is about 20 parts per 100,000. The Committee proceed: "500 tons of such water would have twice as much alkalinity as is necessary to neutralize the sulphur acids derived from a ton of coal containing 1·5 p.ct. of total sulphur, even assuming that no sulphur remains in the clinker. Under these conditions, there is no chance of an acid effluent going into the river, if all the condenser water is systematically utilized for neutralization, and this condenser water before being withdrawn maintains the required alkalinity; but there is a chance of some calcium sulphite remaining in solution. This, although a neutral salt, might be objected to, on account of its property of further depleting the river of oxygen. From the ready oxidizability of sulphurous acid and sulphites, their total conversion into sulphuric acid and sulphates should be easy, in which case the effluent water at Battersea would still retain a certain alkalinity, and would be altered only in the sense of having in solution a small quantity of innocuous calcium sulphate."

Electricians and Cookery Courses.

We see it stated that the Chorley Education Committee have received an offer from the Lancashire Electric Power Company to instal and maintain an up-to-date electric cooker, free of charge, provided the Committee agree to instruction in its use being included in their cookery course. The Company state that current for the cooker would be supplied at 1d. per KW.H.

Institution of Chemical Engineers.—With the continual growth of keen competition, the recovery of important materials which would otherwise be wasted becomes a matter of grave concern for all industrial organizations. Apart from the commercial aspect of the matter, the discharge of many effluents, both liquid and gaseous, forms a menace to the health of both those engaged in the occupation concerned and of the community at large. Some of these problems will be discussed at the Conference on "Vapour Absorption and Adsorption," which is to be held by the Institution of Chemical Engineers in the Rooms of the Chemical Society, Burlington House, W. 1, on Dec. 5 and 6. All interested are welcome to attend and to participate in the discussion.

EDUCATION FOR SALESMANSHIP.

FIRST INTERIM REPORT OF THE GOODENOUGH COMMITTEE.

Marketing Overseas—with Lessons Bearing Directly on Marketing at Home.

On Thursday last was published by H.M. Stationery Office (price 4d.) an interim report, entitled "British Marketing Overseas," by the Committee appointed by Lord Eustace Percy (then President of the Board of Education)—

"To consider the problem of Education for Salesmanship, and to make any recommendations for action that, following such consideration, may appear desirable for the promotion by means of education of greater efficiency in the marketing of British goods and services, at home and overseas."

The following are extracts (in which the italics are ours) from the report which are of most direct interest to readers of the "JOURNAL," though the whole report could be read and studied by all with both interest and profit. As the Committee remark, some of the principles they have emphasized are "truisms," in the sense that they are obviously true, but not in the sense of being invariably adopted.

NATURE AND SCOPE OF THE COMMITTEE'S INQUIRY.

In considering what was the subject matter of our inquiry, we necessarily took into account the statement made by Lord Eustace Percy, in his preface to the Memorandum on "Education for Industry and Commerce" in which he gave the reasons which had led the Board to arrange for this inquiry, as follows: "We need an inquiry which will cover not only technical schools, but the whole field of higher education. For that purpose, the obvious subject is education for salesmanship in its widest sense, including the study of markets and marketing, with particular reference to the export trade. This inquiry will be a wide one."

In interpreting our instructions we have therefore regarded—as indeed any body of business men and women must necessarily regard—"Salesmanship in its widest sense" as covering, not merely the work of the commercial traveller and of the salesman behind the counter, in the showroom, or on the exhibition stand, but the whole art of finding, catering for, and developing markets for the products and services of our manufacturers.

Salesmanship as we understand it is a prime function of direction and supreme management; not merely of sales management. It embraces the study of the fundamental principles of commerce and the planning of policy based upon them, as well as the selection, training, and direction of the personnel required for translating policy effectively into action. Salesmanship is the basis of all commerce, the first and last object of which is to market goods or services to the mutual profit and lasting satisfaction of buyer and seller.

Education for salesmanship is therefore education for Commerce on its creative, organizing, and executive sides; and, in Lord Eustace Percy's words, "covers the whole field of higher education."

Some of the matters which we discuss in this report are not in any sense of the word "educational." We are convinced, however, that it would be impossible to deal with the question of the selection and training of the commercial employee without an understanding of the environment in which he has to work. Moreover, that question should be approached by the employer in its relation to other questions affecting the organization of overseas marketing.

We are fully aware that many firms and associations of firms reach a high, some the very highest, standard of efficiency and have evolved systems of salesmanship not only admirably planned and organized in themselves, but also flexible enough to meet the rapid changes in the conditions of modern markets. But the general level of prosperity of British trade must depend on the methods of the average firm. In the highly and increasingly competitive conditions of trading in overseas markets to-day, it is a matter of national interest and urgency that the standard of efficiency in overseas marketing should as soon as possible be raised in every trade and in every firm to as high a level as it has reached in some.

FACTORS IN OVERSEAS MARKETING.

Then follows a chapter dealing with "Some Factors in Overseas Markets" which is largely of interest to those engaged in the export trade, from which we quote only a few sentences which have application to marketing at home as well as abroad, and need only a few verbal alterations to make them directly applicable to our own industry.

One witness remarks that "it is easier to make than to market." In one sense this is an overstatement of the case, since a firm has already gone a long way towards facilitating sales if the goods produced are up to date and in every way suitable to the markets for which they are destined. The possession of these qualities implies, however, a careful and continuous study by the firm of the needs of importing countries, a matter which we regard as an integral part of successful marketing, and to which we shall return later. *The above quotation, therefore, deserves the careful consideration of the manufacturer, whose interest is often largely engrossed in the many and fascinating problems of economical production, problems that are ever present to his eye and constantly stimulate his ingenuity, his powers of organization and his gifts for administration; problems for the solution of which he may have received special education and training, and therefore have a special predilection.*

Before leaving this part of our report, we may refer to one other matter which has a more encouraging aspect than some of those discussed above. Apart from a recognition of the high standard of British goods, there is a definite preference shown by a number of countries for trading with British exporters. This may be partly explained, in some cases, by racial and cultural sympathies, and in others by the investment of British money in foreign railways and other public works; but to no small extent it is due to a liking for British business methods. One witness says of the Turkish market: "The reputation for reliability enjoyed by British goods, and the tradition of fairness and scrupulous observance of their contracts built up by British firms, constitute a most valuable asset." Similar evidence is volunteered by witnesses in several other countries, and there is no doubt that this fundamental principle of sound and successful trading is widespread.

It will be realized that its importance is perhaps most obvious in dealing with the less advanced markets. The Burma Chamber of Commerce says: "The British trader overseas enjoys a great reputation for integrity, and it is of great importance that this should be maintained." If, in the course of the report, we have to draw attention to weaknesses in British selling organization and methods, we must not be thought to be unmindful of this great source of strength. But, obviously, if too much reliance were put upon it, to the neglect of efficient salesmanship, what should be a source of strength would become a cause of failure. "Easy won is easy lost," applies to more occupations than that of speculating.

The evidence suggests that the British manufacturer . . . should not rely upon reputation, tradition, or other favouring conditions, as a substitute for the constant study of the world's markets on the spot, or for the more complete and efficient methods of marketing, either individual or co-operative.

This brings us to the very interesting chapter headed

THE SALESMAN.

It will be understood from what was said in our Introduction that in using the word "Salesman" as the heading to this chapter we give it a very wide meaning. As we look at it, every member of a firm, of whatever grade, who is concerned with the marketing side of the business, or is in a position to assist in (or to hinder) the achievement of the ultimate aim of its operations—namely, the enduring satisfaction of the customer—is, to that extent, a salesman, though he may be employed in the factory, warehouse, or office, and have nothing to do with the actual selling transaction. One of our witnesses says: "The most important salesman is the head of the firm;" and we agree to the extent, at least, that the initiation, organization, and vigilant maintenance of the firm's sales policy must be the primary and constant concern of the principals.

Our evidence shows that British salesmen are often not as well equipped as they should be for the difficult and important work which they have to perform.

Employers' Responsibilities.—It must not, however, be thought that we or our witnesses are indulging in any general criticism of a body of men, many of whom are highly efficient. As we see it, where deficiency is observed, the question is partly one of making better use of first-class material, partly one of taking more effective steps to develop promising material, and partly one of offering remuneration on a scale high enough to attract sufficiently good material to use or develop.

The action to be taken to deal with these points must be taken, in the first place anyhow, by employers. The deficiencies which are brought to our notice are, we believe, often due to faulty methods of selection, inadequate training, inadequate remuneration, and lack of direction and support from headquarters. For none of these is the employee in any way responsible. Several of our witnesses, as was to be expected, express opinions which are very favourable to the individual British salesman. In more than one case, however, witnesses comment on the small number of British travellers visiting the countries on which they are reporting, good though those few travellers are; and, generally speaking, the impression given by the evidence before us is that in the matter of direct representa-

tion abroad, both as to quality and quantity, many British traders have not moved with the rapidly changing times.

THE QUALITIES OF THE SALESMAN.

We need not consider at any length the moral qualities with which the salesman, and indeed the good business man of every kind, should be equipped. *They are the qualities of the good citizen in any walk of life, and are shortly but completely covered by the Golden Rule of doing as you would be done by.*

We would only emphasize the importance of giving full consideration to all the evidence obtainable as to the character and home environment of candidates when the selection of salesmen is being made. They frequently work without direct supervision under conditions of considerable temptation, and they carry the reputation of their firms and of their country in their hands. Absolute integrity is an essential, and for the rest the overseas salesman particularly needs fortitude, patience, and enthusiasm. "Personality," again, is most important, and the word frequently recurs in our evidence. We are content to follow one of our witnesses in drawing attention to the fact, without attempting to define something which is so elusive, but at the same time so easily recognizable.

Social Qualities. As regards social qualities, tact and adaptability are essential as ensuring that the salesman will quickly conform to the usual standards of intercourse and easily make friends in any country in which he finds himself. The need for courtesy and for a certain degree of responsiveness, even to strangers—the importance, in a modern phrase, of being "a good mixer"—is emphasized by a large number of witnesses from very different countries, both new and old. Although definite criticisms on the ground of lack of adaptability are rare, the constant emphasis on the need for this quality is, in itself, eloquent.

Good manners are fundamental; but the way in which they show themselves will, of course, vary considerably in different countries. It should be unnecessary to labour the point that the social life of (say) the Chinese, the Danes, and the Canadians is far from being the same. It is, however, worth remarking that very frequently an intelligent acquaintance with current local events (for which a knowledge of the language of the country is essential) is a direct aid to business. This would be true, for example, of Italy; and a witness in Egypt says: "Particularly in this part of the world, where a salesman is expected to entertain to a certain extent, he should be able to take an intelligent interest in matters other than the immediate business in hand." And again: "A business proposition of any importance must be introduced tactfully and with caution in the course of general conversation." While the native purchaser in the Near and Far East may enjoy a leisurely approach to matters of business by way of other subjects, the contrary is true of a number of markets.

Not least, of course, though mentioned last of the essential qualities of the salesman, is knowledge—of his goods, of his customers, of the world generally. This brings us naturally to our next section.

EDUCATION AND TRAINING OF SALESMEN.

The evidence on this subject falls conveniently under the following heads:

(*a*) General attainments.
(*b*) Knowledge of foreign languages.
(*c*) Knowledge of foreign markets, including prices, methods of payment, and methods of transport.
(*d*) Knowledge of commodities.

All the last three can be acquired in part by some form of study, though we realize, of course, that study must in every case be supplemented by experience. So much is obvious. But we are not yet ready to report upon the further question of how far such knowledge can, and should, be acquired by education in the school or university, and how far by special instruction and practical experience in a business concern—a question on which our present evidence naturally gives little direct guidance.

General Attainments.—The Association of Chambers of Commerce says: "With regard to the qualifications of salesmen themselves, the Association does not wish to do more than suggest that a good general education, rather than specialization, is the prime necessity for boys desiring to enter commercial life." This proposition as to the importance of general education is supported, specifically or by implication, by all our evidence, and the only doubt is as to the precise meaning which the various witnesses attach to the phrase. Broadly speaking, however, we think it represents at least a good secondary school education or its equivalent, though our evidence suggests that for some forms of work, in certain markets anyhow, a university graduate would probably be the most suitable man.

Though our evidence clearly points to the fact (explanatory of other deficiencies) that the standard is not by any means always reached, the need for well-educated men, recognized by our witnesses on broad grounds, will be generally conceded, and, more particularly, because, as one of our witnesses points out, "the mind of the salesman must . . . be moulded by education to a capacity for investigation and analysis, and trained to appreciate and use economy and method in pursuit of inquiries and ascertaining of facts. Otherwise he cannot form a reliable judgment of marketing and selling conditions as he finds them, and convey a convincing report and conclusions to his firm."

Knowledge of Foreign Languages.—We are convinced that it is always desirable and often essential that the salesman should have a good knowledge of the language, written and spoken, of the country where he is stationed. . . .

. . . The subject is, indeed, of such paramount importance, and its urgency was so much impressed upon us, that, in February last, we asked for an inquiry to be undertaken by the Board of Education into the teaching of foreign languages in this country and in certain selected foreign countries. Lord Eustace Percy acceded to this request, and the inquiry has been undertaken by officers of the Board, under the direction of a Sub-Committee which we appointed to deal specially with the subject. As at present advised, we intend, in view of the urgency of the matter, to make the findings of the Sub-Committee the subject of a second interim report.

Knowledge of Foreign Markets.—The salesman, once he is stationed overseas, must, of course, devote his energies constantly to a study of his market or markets. The efficient man will do this to the full extent of his abilities, the inefficient man will not.

Knowledge of Commodities.—Our witnesses either state specifically, or quite evidently take it for granted, that a salesman should have a thorough knowledge of the goods which he is to sell. The proposition is, indeed, self-evident. Though a few criticisms are made, for instance by one or two Chambers of Commerce in the Far East, the tone of the evidence generally suggests that British salesmanship is satisfactory from this point of view.

The point has sometimes been put to us that expert knowledge is of far greater importance for the selling of non-standardized and specialized goods than for standardized and branded goods, of which certain types of foodstuffs are obvious examples. It has even been suggested, though not by our present witnesses, that for some lines too much knowledge may be a dangerous thing, because *salesmen may weary a customer with technical dissertations.* Without going into this point, which, after all, mainly concerns the common-sense of the salesman, we may notice that one or two witnesses advocate that the prospective salesman should spend some time in the factory or workshop before going out. For example, the Hong Kong Chamber of Commerce says: "A salesman should . . . have a thorough knowledge of the article he is selling, and should be able to explain how the articles are manufactured, where the raw material is produced, the method of packing for shipment abroad, &c. To achieve this, training in the workshops at home is invaluable."

The evidence of the Association of Chambers of Commerce emphasizes the absolute necessity of expert knowledge by the salesman of "goods of a technical description."

THE STATUS OF THE SALESMAN.

The word "status" is used here in a wide sense to cover both the pay and prospects of the salesman and also his standing in the firm's marketing organization when he has taken up his post overseas. Speaking generally, *we regard it as axiomatic that the maintenance of an adequate, efficient, and high-class body of salesmen is a vital factor in prosperity in overseas trade.* If their profession is treated as "a minor sort of occupation," in the words of one of our witnesses, and only to be adopted "as a last resort," and if pay and prospects correspond to such treatment, it is idle to hope for the retention, much less the development, of British trade. We shall have to return to this subject in our Final Report, but we agree with one of our witnesses who says that "the profession of selling goods, especially abroad, is even more complicated than manufacturing goods in modern mass-production methods; and the faculty of being able to tackle with success each individual country and each individual selling question is one which seems to be exceedingly rare."

Quality and Pay of Salesmen.—Though in certain markets and for certain branches of trade our evidence shows that the British salesman is usually of an excellent type, such evidence is by no means universal. There is, in fact, ample support for the opinion that "in order to attract the right kind of man, an endeavour should be made to raise the status of the salesman." Thus one witness says: "British firms do not in my experience attempt to secure men of the really high calibre required for this (a salesman's) work."

Our evidence emphasizes that the ideal representative in a foreign market is one who has the standing of a principal in the firm which he represents, and as this is obviously not always possible, then a representative of the calibre and attainments corresponding to a principal is desirable if British trade overseas is to make progress in the face of modern competition. This witness adds: "Unless British firms set a greater price on efficient representation and salesmanship abroad, it may be found that the best produce of our School of Salesmanship, if it is ever created, will be selling American instead of British goods." Finally, one of our members tells us that: "Comment has also been made on the fact that the present large number of German commercial travellers—mainly connected with the retail trade—which is now in South Africa is drawn

from a higher social grade than has heretofore been the case, often consisting of university graduates speaking several languages. In this they are said to compare favourably with those sent out from home."

The Salesman and the Home Firm.—Closely connected with this matter is the position of the salesman overseas in relation to the home firm; and there is much evidence that he is not allowed enough responsibility. The Association of Chambers of Commerce says: "It has been suggested that irksome limitations are sometimes placed on salesmen by head offices in such a way as to hold up the negotiation of business." As this quotation indicates, it is not merely a matter of the feelings of the salesman, though that is important, but also of the effective transaction of business. Thus a witness in one of the Dominions says that in that market "the salesman should have comparative freedom of action, in many cases to the extent of being allowed to make, on his own responsibility, minor adjustments of price. Many orders have been lost by British firms because a local representative has been compelled to cable his principals with regard to relatively unimportant matters or a trifling change of price." We agree with him that to reply that it is not safe to trust the representative to such an extent, begs the whole question. *It is a prime necessity to choose a good and reliable salesman; then, having done so, full support should be given to him.* A second fault is not excused by an even greater one preceding it.

Summary.

To summarize this chapter, the evidence suggests that steps should be taken to raise the quality, and, in some markets, to increase the number, of representatives of manufacturers and merchants trading in overseas markets. Such representatives, whether principals or professional salesmen, should possess: Good character; attractive personality; the capacity for making friends; suitable social qualities and manners; knowledge of human nature; good general education, including especially foreign languages; ability to investigate and report; knowledge of the goods or services they have to sell; knowledge of the country to which they are sent, of its language, customs, geography, history, and peoples, and of the methods and facilities for doing business which prevail, including banking, credit, and transport; experience in selling; the confidence of the firm.

Manufacturers and merchants in overseas markets are reminded that they cannot get a good representative, any more than they can get a good article, unless they are prepared to pay a good price. . . .

Essentials of Successful Marketing Overseas.

Chapter IV. deals with "Some Essentials of Successful Marketing Overseas" from which we extract only one or two paragraphs. These have clear application at home if the word "overseas" is omitted by the reader.

As one witness says, "Salesmanship not only concerns the actual selling of goods. It should cover everything that relates thereto, e.g., packing, ocean and rail freight, customs duty, port charges and service after sale, where necessary." Such aspects of trading, though some of them primarily concern the home staff, are, again, closely related to the study of the market by headquarters and by the firm's overseas representative. The importance of accuracy and efficiency in these matters will not, of course, be disputed in theory, but our evidence makes it clear that all is not well in practice. We think it right, therefore, to detail certain points which should be remembered and certain defects which our witnesses notice in British methods.

Delays in Delivery.—British exporters have been frequently criticized in the past for delay in delivery of goods, or for requiring an excessive time for delivery. Though there is reason for thinking that this shortcoming has been largely remedied in some markets, there is, to judge from our evidence, still ground for criticism. The export manager, it is said by one of our witnesses, "should hold that deliveries on the promised date are as important as his prayers," and implies that many do not, while another witness, speaking of a European market of a difficult character, states that a good deal of harm has been done on occasion by British firms failing to make delivery up to time. Another says: "It is perhaps also worth pointing out that complaints are frequently heard that English firms are less expeditious in answering letters and inquiries and in submitting quotations than German houses." Complaints of failure to make delivery up to date, or of delay in supplying quotations or tendering for contracts, have also reached us from other sources.

We agree with a witness that the ideal should be to give "the prospective customer what might be termed a 'no trouble' quotation, and thereby enable the British article to compete on level terms with its rival." *We would, indeed, prefer that Britain should lead the world, not merely follow or equal her competitors, in studying and satisfying her customer's needs, tastes, and convenience.*

Service.—Much of the evidence which we have received emphasizes the vital importance of service, notably in regard to machines and machinery of all types. A witness in one of the Dominions says: "The man who is selling British goods here must be able to give 'service' where service is needed. . . . Promises of service are naturally of little avail if the firm have not proper facilities here. In a number of trades we have lost a great deal of business for that reason."

It should be unnecessary to emphasize the point that *an individual selling transaction will mean comparatively little in building up trade unless the article sold is properly used.* The transaction may even prejudice the development not only of the trade of an individual firm, but of British trade generally, if it is not followed up, and supplemented by efficient service where necessary. We know that this cardinal principle is acted upon by many British firms, but our evidence shows that its practical acceptance is not, as it should be, invariable.

Publicity.—The Association of British Chambers of Commerce says: "The desirability has been suggested to the Association of carefully prepared publicity schemes, with particular reference to the need of working through local publicity agents cognisant of the conditions of the market and mentality of the public." It may perhaps be fairly inferred from this that the constituent Chambers consider that the publicity methods of British firms may be improved; and this is the opinion of other of our witnesses, expressed with varying degrees of emphasis.

We recognize that an extensive advertising campaign may not be possible for a small firm, and in this connection one of our witnesses suggests the possibility of a system of co-operation in advertising—for example, under the auspices of a trade association. It is well known that much success has attended schemes of co-operative publicity in this country.

Gravity of Criticisms.—In conclusion, we may add that throughout this chapter, as throughout the report, we have tried to put with moderation the various points raised by our witnesses, and we fully recognize that no particular criticism applies to all British exporting firms, and that some criticisms, perhaps, apply only to a minority. At the same time, we regard it as a very grave fact that a large number of competent witnesses having the interests of British trade much at heart, and seeking only to be of service to the Empire, should so often have to criticize British methods, and so often think it necessary to insist on principles which might be expected to be self-evident to all. It is impossible in face of these facts to believe that all the essentials of successful overseas marketing are grasped and acted upon by the majority of British exporters.

From the concluding chapter we extract a few sentences which need little alteration to adapt to our own industry.

Concluding Chapter.

If we were asked what our evidence shows to be, broadly speaking, the outstanding weakness in British marketing overseas, we should answer: A detached and insular attitude and unscientific practice—relics of the time, long past, when we enjoyed a virtual monopoly of the world's markets for manufactured goods. For this weakness (again very broadly) the remedy is mainly to be found in a policy based on the most searching study of the character and needs of the market; on close, continuous, and sympathetic contact with it; and on *the guiding principle that the complete satisfaction of the customer is the basis of all permanent commercial prosperity.*

If such a policy is adopted, and if it determines the activities alike of the factory, the despatch room, and the office at home, and of the sales organization and personnel abroad, many of the defects noticed in Chapters III. and IV. must automatically disappear. Nothing short of such a policy will be of any lasting effect in the main markets of the world. British goods no longer "sell themselves;" and so far as we can see they never will do so again. British trade must go forward or it will go back. It has, we are deeply convinced, the possibilities of steadily increasing prosperity if, but only if, obsolete methods are discarded and others substituted which fit the conditions of modern trade.

Obviously the organization for putting into operation such a policy as is outlined above requires for its very foundation an efficient, well-trained personnel, from the manager's room through every branch of the business. We hope in our second Interim Report and in our Final Report, which will be prepared with all possible expedition, to make suggestions as to the recruitment and training of salesmen, in the widest sense of the term, which will be of direct use to the British business world. A good deal of light is thrown on that most important subject by our evidence here, which is in the nature of a diagnosis of trouble for which we are asked to help in finding a remedy; but, as we have said, we are not yet prepared to make our statement or submit our conclusions.

The other questions affecting British trade overseas, with which this present Report deals, are, however, ready and waiting for consideration by all concerned with that trade, whether as manufacturers or merchants.

We ask that everyone should realize that there is a critical situation to be faced; that in the national interest our evidence should be examined without prejudice and without delay; and that each individual reader should approach the subject with a fixed determination to apply to his own trading organization any lessons which our evidence has to teach him, and to accept that evidence in the spirit in which it is tendered—that of a desire to be of service to British industry at home and British commerce abroad.

The Report makes a splendid subject for discussion by the Gas Salesmen's Circles.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION (AUXILIARY SECTION).

Papers of special interest to the gas industry, "Gas-Works and Benzole Recovery," by Mr. F. Nicholls, B.Sc., A.I.C., Senior Chemist, Newcastle-upon-Tyne and Gateshead Gas Company, and "Dirt in Coal; its Influence on Carbonization," by Mr. W. E. Plevin, B.Sc., Shift Engineer, Blackpool Gas-Works, were read at the Nineteenth Half-Yearly Meeting of the Auxiliary Section of the North of England Gas Managers' Association in Newcastle on Saturday, Nov. 30. Mr. G. E. ANDERSON, B.Sc., Works Manager, Howden Gas-Works, presided. The papers are published in later columns.

The CHAIRMAN explained that they had to elect at this meeting a new Chairman and Vice-Chairman and two members of the Committee. It gave him much pleasure to announce that the Committee had recommended Mr. L. M. Welldon, of the West Hartlepool Gas and Water Company, as Chairman for the ensuing year, and Mr. J. E. Dixon, of the Newcastle-upon-Tyne and Gateshead Gas Company, as Vice-Chairman. Mr. Welldon, Mr. Anderson remarked, had done much valuable work both for the Committee and in reading papers. They looked forward to a prosperous year under his Chairmanship. Mr. Dixon, as his deputy and probably his successor, was a man whose experience well fitted him for the position.

Seconded by Mr. J. H. RACE, of Sunderland, the proposal was unanimously agreed to.

Mr. J. B. Henderson and Mr. L. H. Sensicle, both of the Newcastle-upon-Tyne and Gateshead Gas Company, were elected to the Committee.

ROAD TAR.

By H. C. HEAD, M.Inst.C.E

[From a Paper before the Public Works, Roads, and Transport Congress, Nov. 18.]

From the wide standpoint of public policy, tar is a British product of primary importance in the gas industry and the coke oven industry. If British tar does not find a ready use at a fair price, then inevitably the cost of coke, steel, and gas will be adversely affected, while the struggling coal industry will be badly hit because of the harm done to its biggest customers.

The use of British tar for British roads is vital to the gas undertakings. The coke oven industry, the steel industry, and the coal mines are no less intimately affected, and yet no steps have been taken to work out a national roads policy that will secure, with due regard to quality and price, the fullest use of British tar. In fact, we find that imported bitumen, in the main brought here by American oil companies, is being used all over the country in place of our own tar, thus providing profits and work abroad, instead of at home among our own people.

"TALK TAR."

In the author's opinion, this preference for bitumen is due not so much to its merits as to the highly skilled sales organization employed by the American companies. Bitumen has behind it all the up-to-date selling methods usually applied to tooth-paste and patent medicines. British tar, on the other hand, is left to sell itself, in the same way as the British telephone. The author is convinced, therefore, that if tar is to be used in accordance with its merits, it must receive the backing of skilled salesmanship. We have learned, during recent years, how to make tar; now we have to learn how to talk tar.

It is not a mere matter of sentiment whether tar or bitumen is used on our roads. As a matter of fact, British tar is, in the majority of cases, the best material for the purpose, and "British Tar for British Roads" is no idle slogan, but an entirely justifiable appeal to help home industries.

In the gas industry, for example, it is estimated that a decrease of one penny per gallon in the price of tar means a loss of no less than £800,000 per annum, or a halfpenny per 1000 c.ft. of gas, to the gas undertakings of the country. This is sufficient to show what tar means to the gas industry. If for any reason this enormous sum is lost, that loss will have to be made good in one way or another by the British people. Either the price of gas will have to be raised or the gas companies will be compelled to force down the price of coal, and in consequence the workers and the public must suffer.

In the coke oven industry an average yield of 9 gallons of tar is obtained from one ton of coal, so that every penny per gallon gained or lost on the tar means ninepence a ton on the price of coal, which may make all the difference between a pit making a profit or a loss.

In the steel industry, again, 35 cwt. of coal have to be carbonized to give the coke required to produce the iron for one ton of steel. As the carbonization of 35 cwt. of coal yields 16 gallons of tar, every penny per gallon lost on tar adds 1s. 4d. per ton to the cost of steel, thus possibly crippling the steel manufacturer in his fight for foreign markets. It will be seen, therefore, that tar cannot be isolated as a problem concerning only the road maker. Its repercussions affect whole circles of industry, and these, the author would urge at the outset, must be taken into account both by our highway authorities and the Ministry of Transport.

The present price of tar makes it the cheapest form of recognized road-making material, but despite this, large quantities of imported road material are being used. There is no reason why the whole of the available output of tar should not be taken up for the making and maintenance of our roads, thus providing greater security and prosperity for important home industries and employment for large numbers of men.

The cash value of our roads is broadly £1,839,659,000. In the bulk they are the product of refined tar and approved aggregate, both materials scientifically prepared and skilfully incorporated. Our British roads are a fine monument to British skill—a credit to all concerned, and, in the author's view, there is no reason why they should not continue to be built of British material. The importance of our roads has now been recognized, academically, by the establishment of a Chair of Highways Engineering at London University.

HINTS TO TAR DISTILLERS.

The following are points which it is felt should be emphasized to tar distillers and other refiners. First, there is the importance of knowing exactly what the surveyors require. This can only be learnt by meeting surveyors and discussing with them their needs. Useful work in this connection has been done by the British Road Tar Association, but unfortunately the conferences have been allowed to fall into abeyance. They should, the author feels, be revived without delay for the discussion of such matters as the quality of tar required, its economical production, and the best means of utilization. Surveyors should be encouraged to attend the meetings and to express their views. The author is certain that the tar producers and distillers would wish him to mention here the cordial way in which surveyors have met them in the past, and the very great assistance they have rendered. It is the hope of all concerned that such welcome assistance will continue to be forthcoming in the future.

Next in importance, or even bracketed with the foregoing, comes the quality of the material and its suitability for particular needs. The needs of each individual road must be a matter for continual experiment, and when it has been ascertained what is required for the particular purpose, the best tar of uniform quality must be forthcoming, and this not at any extravagant price.

Another important factor, as has already been indicated, is the wise use of advertising. The fact that tar can be made suitable for roads generally, and indeed for any road in particular, must be brought before those responsible for the upkeep of the roads. There is, of course, no suggestion of interference with the road engineers, but only an offer to collaborate with them in providing the tar most suitable to their needs. They must be made aware, by up-to-date publicity, that the advice of the tar expert is always at their service.

With regard to British roads, everyone will realize the need for the use of British tarred stone, tarred slag, &c., and the advantage of not sending large sums of money to America when suitable material can be profitably produced at home, thus providing a maximum of work for our unemployed without increasing the payments which Britain has already to make to America to the prejudice of our exchange rates.

USE OF ROAD TAR ABROAD.

There is also a large untapped field for the use of tar abroad. The French road authorities ensure that tar shall not be exported to the detriment of adequate supplies for use on their own roads, but the mileage in France is large and the production of tar is nothing like so high proportionally as in this country. France makes her own tars, but has room for imports. Spain again appears to offer a wide field. Other countries in the south of Europe are in the same case, and even the North African Coast is not without great possibilities.

In this connection, it should be mentioned that experiments are now being carried out in the use of tar for roads in India,

where the conditions are exceedingly difficult, having regard to the intense heat and drought during one part of the year, and the immense rainfall in another, all trying conditions for any road material.

SLIPPERINESS.

There can be no finality in the advance towards perfection with an ever-increasing fast moving road traffic. The cry at the present time is not so much for the durability of the highway—this has been achieved—as for "a safe surface." Having regard to the weekly statistics of fatalities and accidents, it is only to be expected that this should be the first demand of the travelling public or the road engineers. The desire of every user of the highway is to feel a "sense of security" under the many changes of hail, rain, and sunshine, all experienced in a very brief space of time. These conditions call for a "grip" from the road, and "care" by the motorist. The road must offer to the rubber tyres of the car a "grip" and to the horse a "foothold." Without wishing to draw invidious comparisons between one material and another, it may be said that refined tar is firmly established in this direction, and in this country it may lay claim to the great bulk of those roads which are recognized as "fast traffic safe roads" under all the vagaries of our inclement weather conditions.

That a tarred road is a safe road is now universally admitted, and in many cases the newly-constructed arterial roads, after being in existence only a short time, have had their surfaces tarred in order to render them safe. It is not too much to say that at the present time the best road surface for the ever-increasing motor traffic and also for horse-drawn vehicles is a tarred surface properly grítted.

Experiments were carried out some time ago by Major Clements on the co-efficients of friction of rubber on road surfacing materials, and the results are given in a paper, "The Evolution of Modern Roads" (J. R. S. A., Jan. 20, 1928). Major Clements states that the co-efficient of friction of rubber to a tarred surface is lower than that of rubber to a bitumen surface. It is clear, however, that he is referring to dry road surfaces, so that this is not a criterion by which to judge the slipperiness of a road. Experiments should be carried out with a wet or damp surface. This is the surface which is so dangerous to-day, and to which attention must be directed, so that we may "make the roads safe for democracy to drive on."

DAMAGE TO FISH LIFE.

Some word should be said about the damage to fish life—a charge frequently preferred against tarred roads.

In any case there is danger to streams from the use of any impervious road surface. Directly a road is rendered waterproof, there is a large increase in the risk of damage from the washings from it, whereas in the past, with a more or less porous waterbound road, the moisture from horse-droppings, or any water or oil from motor cars and from the dust itself, was absorbed by the road, or, in the case of the dust, left on its surface. To-day, after a dry period, the whole of the filthy matter, dry manure, dirty lubricating oil, dust—practically dried sewage—is washed by the rain into the surface water drains, or into any adjacent river, doing much more damage than anything used in the composition of the road. This is a matter which has to be recognized and faced.

As in the case of concrete roads, it is now generally recognized, and officially accepted, that the risk of damage to fish life is just after the road is laid. It is well known that "Bristowes Tarvia" are willing to lay their products on roads near fishing streams and give a guarantee to indemnify the user, if necessary. The author has not the slightest doubt in his mind that tar has been made the scapegoat for the evil effects of many industrial effluents, and that with a well-made, high-viscosity tar, properly laid and blinded, the risk of injury is remote.

The whole of the fish question is one which is receiving attention, and we may hope for some favourable official pronouncement in the near future.

MR. KILPATRICK'S SCHEME.

Special reference should be made to the success of the warm laid roads by the so-called hot tar process (which Mr. Kilpatrick has successfully developed) and to tarcrete, in which a minimum void mineral aggregate is coated with a soft pitch. To this latter mixture, which is laid hot, the name "Tarcrete" has been given.

Road tar can be used in many ways for road work. One of its important advantages is that local material can be used with it, and its adaptability for road uses ensures economy in that unskilled labour, under expert supervision, is all that is needed for its application. An additional advantage is the resiliency of the tarred road. It absorbs the impact shocks imparted by heavy mechanical traffic, and its life is thus materially lengthened. Throughout the country tarred surfaces are becoming increasingly recognized in road engineering circles as being by far the safest for all classes of traffic, permitting as they do of easy driving, with the necessary grip to ensure safety.

So far, the principal uses for tar have been in the making of roads by tar-grouting, waterbound granite, slag, or other suitable stone. Under suitable conditions, treated with tar of high viscosity or even higher pitch, these materials provide us with roads which become practically a mosaic set in pitch, thus producing a very fine waterproof road offering a non-skidding surface to the rubber wheels of motor-cars and a good foothold for horses. In fact, the foothold of these roads is equal to that formerly offered by the old waterbound macadam or gravel and other stone roads, with this difference, that the new roads avoid the old rough surface.

Advances have been made recently in this matter of road tar. A very valuable book ("Standard Methods of Testing Tar and its Products") has been published on the sampling of road tars, which will be of great value in ensuring that samples are properly taken, and ensuring the proper basis for comparison. Standard specifications have been adopted by the British Engineering Standards Association, and accepted by the Ministry of Transport. Such specifications have been approved, and will, it is expected, be adopted officially in lieu of the present specifications before the end of the present year.

If the author might make a suggestion, it would be that the British Quarry Owners' Association and the British Road Tar Association should confer together, and jointly issue specifications and directions for the making of tarred and tar macadam roads, so that all concerned may have before them an authoritative statement as to the best practice in modern road-making—and that with British materials.

GAS ACTS FOR 1929.

(*Continued from p.* 511.)

SHEFFIELD.

The main object of this Act is to consolidate the Sheffield Gas Acts and Orders, 1855 to 1928. The existing ordinary capital of the Sheffield Gas Company consists of £1,736,968 of ordinary stock; and they are authorized to raise additional capital up to the amount of £600,000 in new ordinary and preference shares or stock. By way of loan capital, the Company have raised £95,000 of 4 p.ct. debenture stock, and £485,000 of 7½ p.ct. mortgages; and they are authorized to borrow further sums not exceeding in the whole one-third of the additional capital raised. The rights of the Company and the Rotherham Corporation in respect to the laying of mains and the supply of gas within an area situate in the limits of both the Company and the Rotherham Corporation are defined by an Act of the latter passed in 1904; and similarly the respective rights of the Sheffield Gas Company and the Stocksbridge Gas Company are defined in the latter Company's Act of 1919.

By the Act, the Company are authorized to raise such an amount of additional capital by way of ordinary or preference shares or stock as will produce (after taking into account premiums or discounts) the sum of £600,000, already mentioned. Existing stock and all ordinary stock forming part of the additional capital, and so entitled to a basic rate of dividend of 5 p.ct. per annum, shall be deemed to form part of one and the same stock. Power is given to raise, by the issue of debenture stock, sums not exceeding £580,000. The Company may also borrow on mortgage sums not exceeding in the whole one-third of the amount of additional capital raised.

The Act contains a number of interesting clauses which were set out in the "JOURNAL" for Jan. 16 (p. 160). A clause empowering the Corporation to appoint an inspector of meters has been deleted.

The declared calorific value of the gas is to continue at 500 B.Th.U.; and there are clauses regulating testing, one of which is to the effect that the Corporation may from time to time (if they think fit) appoint a practical chemist, or other competent person, to test the quality of the gas supplied by the Company, and the Company shall pay him a remuneration for his services, to be fixed by the Corporation, not exceeding twenty guineas a year, or such other annual sum as may be agreed between the Directors and the Corporation.

COKE OVEN GAS.

The Company may enter into agreements for the purchase of coke oven gas, and may supply such gas to any authority, company, or person within the limits of supply for any purpose. They shall not, however, furnish coke oven gas for lighting purposes unless it is of the calorific value and purity, and furnished at the pressure, prescribed. In connection with coke oven gas

supply for lighting, the Company are to be subject to the same obligations as in respect of any other gas for this purpose, and any coke oven gas so supplied may be tested in like manner as other gas sent out by the Company. None of the provisions of the Act, or of the Gas Regulation Act, 1920, with respect to the calorific value, purity, pressure, testing, or price of the gas supplied by the Company shall apply to coke oven gas supply for purposes other than lighting, and by means of mains or pipes through which other gas is not supplied; but nothing in this section shall deprive any person within the limits of supply of any right which he may possess of requiring a supply of gas of the calorific value, &c., prescribed under the Act, or the Gas Regulation Act. It shall not be lawful for the Company at any time to supply coke oven gas which does not possess a distinctive and readily perceptible smell.

The Secretary of State for the Home Department may, at any time either before or after the Company shall have commenced to give a supply of coke oven gas to consumers, make, in the interests of safety to persons, regulations, terms, and conditions with respect to such supply.

There is provision that, if any local authority or company supplying gas in any parish outside the limits of supply, in which the Company have, before the passing of this Act, laid mains under the provisions of the Act of 1917, or the present Act, shall request the Company to supply them with coke oven gas, the Company shall do so, and for this purpose shall permit the authority or company to connect the necessary pipes and apparatus with the Company's mains.

Basic Prices and Basic Dividend.

The basic prices of gas supplied by the Company are to be, for gas supplied within any part of the limits of supply other than the Dronfield limits, 7d. per therm; for gas supplied within the Dronfield limits, 10d. per therm. These basic prices may, at any time, and from time to time, be revised by an Order made by the Board of Trade. The basic rates of dividend on the ordinary capital of the Company shall be, on the existing stock, 5 p.ct. per annum; and on any ordinary shares or stock to be issued after the passing of this Act, such rate per cent. per annum (not exceeding 7 p.ct.) as may be authorized by the resolution creating the shares or stock.

[*Parliamentary Agents: Messrs. Rees & Freres.*]

GAS-WORKS AND BENZOLE RECOVERY.

By F. Nicholls, B Sc., A I.C., Senior Chemist, Newcastle-upon-Tyne and Gateshead Gas Company.

[A Paper read before the North of England Gas Managers' Association (Auxiliary Section), Nov. 30.]

Introductory.

The recovery of benzole at gas-works may be said to date from the early days of the great war. It is true that as far back as 1881 benzole was recovered at Manchester, when the market price of 10s. per gallon was a powerful incentive. At Beckton, washing for benzole was practised in 1913, but it was not until 1915 that the recovery of benzole at gas-works was practised on an appreciable scale. By 1917, some 700 to 800 works were using tar, while washing with oil was in operation at 80 works, with the expectation that this number would be increased to 150 at a later date.

During the war period there were high hopes that the process would be permanent. Mr. Doig Gibb said it was the definite opinion of gas engineers that it was not going to pay for benzole to be sent out with the gas any more. One of the Technical Journals went so far as to say:

> It is now abundantly clear that the oil-washing of gas for the extraction of crude benzole is a process that has come to stay; and it will in time, in our opinion, become as ordinary as any of the old-established processes appertaining to gas and residuals production.

It is common knowledge that these optimistic predictions have not been fulfilled. In this paper it is desired to deal not with the details of benzole recovery in gas-works, but to consider the question from the view of policy, and to suggest that whatever immediate post-war conditions may have been, it is desirable that the subject be reconsidered as a possible extension of gas-works activities.

During the war, considerable work was done in putting the practice of benzole recovery on a scientific basis and raising it from the level of empirical practice. Neither the plant used nor the exploration work carried out is of temporary character, and, if widely used, should be assets to the country, contribute to its prosperity, and reduce its dependence on other countries for at least one article of general consumption.

By 1918, a majority of those in the gas industry were favourable to the continuance of benzole recovery in peace time, and so it is rather surprising that there was such a general and such a rapid discontinuance of the process immediately after the war. A similar position arose on the Continent. Weissenberger, dealing in 1926 with European conditions, stated that debenzolizing had fallen back since the war. He explained this by the fall in prices, the increasing tendency to use coke for water gas manufacture, and the general fear that benzole recovery caused deterioration of gas mains. Coming nearer home, we find that objections to benzole recovery consist of a claim that it is not a financial proposition, allied with a recital of sundry troubles associated with the war period. A survey of the literature of the industry shows that there is practically no definite evidence as to the financial side of the question. The objector dismisses the monetary side of the matter in a few words, and then proceeds to expatiate at great length on his troubles with consumers, flat flame burners, &c.

One is inclined to wonder whether the financial objections are well-founded, or whether there is not good ground for the contention of the "Commercial Motor" that gas companies take the easy course and leave the benzole in the gas. When dealing with a valuable fuel like benzole, we must not let indifference interfere with its exploitation.

Pros and Cons.

Of course, there were sundry troubles associated with benzole recovery, but post-war conditions, and particularly post-war legislation, have removed most of these. The Gas Regulation Act of 1920, with its imposition of a calorific standard, allied with the increasing use of the incandescent mantle, has removed the greatest obstacle to the continued recovery of benzole. Had the calorific standard been in force before the war it is possible that benzole recovery would not have suffered its post-war eclipse. For instance, Mr. H. E. Copp ("G.J.," Vol. 145, p. 577), an enthusiastic advocate of the process, was compelled to reduce his extraction from 2½ to ¾ gallons per ton in 1919 in order to meet the wishes of his "flat flame burner" consumers.

With the general adoption of naphthalene removal by washing the gas with gas oil, the naphthalene bogey has lost its importance, and expenditure on wash-oil has been reduced by the practice of using the same gas oil successively for naphthalene removal, benzole washing, and final consumption on a C.W.G. plant.

Benzole recovery was unfairly, and certainly unnecessarily, blamed for the distribution of inferior gas and deterioration of mains during the war period. The chief blame may be put down to the quality and amount of coal available and to the increased free oxygen in gas supplied at that period. Researches undertaken in Germany by Herr Körting suggest that it is very doubtful whether benzole recovery has an adverse effect on mains and meters and that possibly the reverse is the case. It may be that both the public and those engaged in the industry have been unduly biased against benzole recovery by its effect on the illuminating value of gas. A reduction of 35 p.ct. to 50 p.ct. in illuminating value is accompanied by a much smaller reduction in calorific value. In the writer's experience, this explains the almost child-like faith of certain people in the naked flame as an index to gas quality and the corresponding distrust formerly shown in recording calorimeters. When a reduction of 50 p.ct. in illuminating value was accompanied by a reduction of only 4 to 5 p.ct. in calorific value the recording calorimeter immediately became suspect. A similar attitude may go far to explain the bias of many, both in the industry and outside it, against benzole recovery.

Apart from the intrinsic value of the benzole recovered, there are certain claims put forward in favour of benzole recovery. With "stripped" gas, there is a reduced tendency to blackening of mantles. According to Whitehead, benzole vapour is 5 to 6 times as heavy as coal gas, and the reduced specific gravity of the stripped gas is an advantage to the distribution engineer. There is less possibility of condensation in the mains, and the gas tends to remain more constant in quality. This effect is very marked in the U.S.A. when gasoline is removed from natural gas. Gas freed from benzole requires a smaller air supply for its complete combustion, and G. J. Walmsley claims that stripped gas gives a more intense heating of the mantle.

Of late years the tendency in retort house practice is to replace other refractories by silica and work at higher temperatures in the struggle for increased thermal yield and greater throughput. Such higher heats tend to a higher production of benzole. This benzole is of more use to the community as a liquid than it is to the gas consumer in the form of vapour

now that incandescent mantles are in such general use. In addition to its use for explosive purposes, benzole is needed in the preparation of bases, such as aniline, toluidene, xylidene, &c., and the starting point for the manufacture of large classes of dyes and drugs. It must be admitted that the demands of this section of the chemical industry are largely met by the benzole recovered from tar, but there is also a large and expanding market for benzole as a motor spirit, and it might be advisable for gas-works to concentrate on the manufacture of motor spirit. In this case there is no objection to washing vertical gas, as the paraffins present possess no disadvantages in relation to motor spirit.

As a motor spirit, benzole possesses several advantages over petrol. It is more powerful and economical, giving greater mileage, and is free from "pinking." Freedom from sulphur and "sooting" troubles may be obtained by careful attention to manufacture and the correct adjustment of carburettor and air. The fact that the first motor-cars were run on petrol accounts in a great measure for the more widespread use of this fuel. At one time insufficient care was taken in the manufacture of benzole, and some of the earlier samples were not likely to impress the motorist in its favour. But the institution of a National Benzole Association, which has undertaken considerable research in evolving a satisfactory specification, has gone far towards removing these drawbacks. It is possible that if greater care had been taken in the early stages of benzole manufacture, the present demand for the spirit would be such that the country would be much less dependent on imported supplies of fuel.

MANUFACTURE.

As mentioned earlier in this paper, it is not proposed to deal in detail with the manufacture of benzole; but certain general points might be considered. The use of green oil, creosote, blast furnace oil, &c., during the war period was expensive and accompanied by high loss and depreciation of the washing medium. These disadvantages may be overcome by the use of gas oil. With this oil there is no trouble with naphthalene; the benzole recovery plant assists in the washing of the gas for naphthalene removal, and pitching up of the oil is absent. Against these advantages must be offset the tendency to form troublesome oil and water emulsions. At a northern gas-works the benzole recovery plant forms part of a scheme in which the gas oil performs three distinct operations. When received into the works the greater part of it is used in rotary washers for naphthalene removal, whence it passes to the benzole plant, and is periodically evacuated to the water gas plant. One portion of the cost of the oil is debited to the naphthalene washers, a second portion to the benzole recovery plant, and the remainder to the water gas plant. This scheme benefits all three sections. There is a tendency to use more oil on the naphthalene washers, and, though this may slightly increase purification costs, the saving in distribution costs should more than balance this. A rebate is allowed to the benzole plant on all oil used in excess of a given amount. This encourages a larger use of wash oil, the cost of which is offset by the increased benzole recovery obtained. Finally, the water gas plant obtains its oil at little more than half price, which is a consideration in these days of acute controversy as to whether it pays to make coal gas or water gas.

The term "gallon of crude benzole" is a rather vague one, and the standard method of assessing the quality of crude benzole is equally vague. Considerable criticism has been levelled at the retort test in which the benzole is distilled, thermometer in liquid, and the quality judged by the amount distilling over at 120° C. The standard is taken at 65 p.ct. This test is unreliable for control purposes on the plant, and is decidedly unfair to poor benzoles. At the northern works control tests are based on the distillation of benzole in a flask and through a 12-bulb column, 70 p.ct. at 180° C. being aimed at. This test is much more reliable and comparative. As the benzole is rectified *in situ*, there is no necessity to make a high-quality benzole in order to reduce rail charges. To facilitate efficient stripping of the gas, a low-quality benzole is made, and here the unfairness of the retort test is strikingly illustrated. The retort test of 65 p.ct. at 120° C. is presumed to show the amount of rectified products available from the crude, and the price is fixed on this basis. A poor benzole distilling 45 p.ct. would receive a correspondingly lower price, yet at this works from a benzole of this quality, 55 to 60 p.ct. is consistently recovered as motor spirit and solvent naphtha.

The recovery of benzole results in the extraction of a certain number of therms which must be credited to the retort houses. Consideration of the average calorific value of crude benzole combined with the result of experience suggests that this is barely one therm per gallon. Recording calorimeters on the gas before and after scrubbing assist in the control of the scrubbers, but are not sufficiently accurate to be used to measure the therms extracted. During the war, some high figures, such as 40 and 50 were given for the B.Th.U. removed from the gas, but experience at this northern gas-works over several years shows that with efficient scrubbing this is of the order of 20 to 25 B.Th.U. The latest recording calorimeters are probably accurate to 1 p.ct. over reasonable periods, but most manufacturers do not claim a greater accuracy than 2 p.ct. when the instrument is new. With age, and changing barometric conditions this figure is often exceeded. Assuming gas at 520 B.Th.U. is being washed with a drop in calorific value of 25 B.Th.U., the recording calorimeters might show a drop in C.V. of anything from − 5 to + 45 B.Th.U. according to the direction in which the errors operated.

The matter is further complicated by the limits of accuracy of the flow calorimeters used to check recording calorimeters. Even with the standard Boys' calorimeter, it is doubtful whether a greater accuracy than ± 3 B.Th.U. can be relied upon. To digress for a moment, one fails to see the need for certain official testings to be reported in decimals of a B.Th.U. or for undue satisfaction when one's official test is within 0·1 B.Th.U. of the declared value. A sense of proportion seems desirable. What says Aristotle?

> It is a mark of an instructed mind to rest satisfied with that degree of precision which the nature of the subject admits, and not to seek for exactness where only an approximation to the truth is possible.

To sum up, it is not feasible to determine daily the therms extracted from the gas by benzole recovery. Using recording calorimeters, sad havoc would be wrought upon the retort house figures. Over a reasonable period it approximates to 1 therm per gallon, and at a northern gas-works the therms extracted are assessed on this flat rate. In addition to coal gas made, a coke oven supply is received into the works. Two instruments of the latest type of Fairweather recording calorimeter are used on the coke oven supply and on the mixture respectively, other types being in use on the gas from the retort houses. With the aid of the Fairweather instruments the therms in the mixture and in the coke oven supply are obtained, and the difference represents the therms made in the retort houses *less* the therms extracted by the benzole plant. These are calculated on the basis of 1 therm per gallon of crude benzole, the resulting figure being credited to the retort houses and debited to the benzole plant.

The benzole plant may be operated for maximum stripping or simply used to regulate calorific value. Modern horizontal retort practice is in the direction of insistent attention being paid to small details, particularly in the avoidance of the slightest leaks in retorts or of "pull" on the retort. If these conditions are faithfully adhered to, it becomes almost impossible to make "straight" coal gas of a lower calorific value than about 550 B.Th.U., and dilution of some kind becomes necessary. Such dilution should take place away from the retort house. In the making of coal gas on horizontal settings, it is the writer's experience that where the calorific value of the gas is reduced by leakages, overpulling, &c., the increased make of gas does not balance the fall in calorific value, and therefore the product, or thermal return, falls. A significant thing is that in the analyses of gas the hydrogen content falls in a greater ratio than the gas make increases, and it is possible that the first effect of over-pulling, &c., is in the direction of an actual combustion of hydrogen at the temperature existing in the retort. This may be mere theorizing, but, seeing that the hydrogen forms more than half the total make of gas, it is important that it should be conserved. In any case, it seems that high thermal returns accompany high calorific value on horizontal settings, and support of this view is surely shown by the high thermal returns secured by the South Metropolitan Gas Company, which supplies gas at 560 B.Th.U. Policy would dictate the manufacture of high calorific value gas in the retort house followed by subsequent dilution, and here benzole recovery assumes an importance beyond its own intrinsic worth.

COSTING.

So far some of the pros and cons of benzole recovery have been considered, but the most important factor is the financial one. Information on this point is almost non-existent, particularly from those who are opposed to benzole recovery. Their attitude appears to be "a polite negative," but that does not carry us very far in the absence of definite figures as to costs. If oils are profitable to low-temperature carbonization companies and similar bodies, then surely benzole has a financial value. The crucial question is, "Will it pay?"

On this point supporters of benzole recovery are only slightly more informative. In 1916, Walmsley stated that with crude at 8d. per gallon, and allowing for operating costs, benzole recovery was one of the best propositions going. At the conclusion of the war, S. E. Whitehead, of the Ministry of Munitions, averred that scores of undertakings found it profitable to make benzole. In 1920, the Anglo-American Company, in the Manchester district, was bidding 6d. a gallon over the crude price of the National Benzole Company, which does not suggest that benzole is an unremunerative proposition or that the market is restricted. G. E. Anderson, in 1924, favoured benzole recovery as reducing the cost of producing a therm, and T. P. Ridley, in 1927, stated that profits were made on benzole extraction.

But while definite costs are scarce, some sweeping

generalizations have been made as to the finance of benzole recovery, both by advocates and objectors to the process. One school of thought states that 1 gallon of benzole will occupy about 40 c.ft. as vapour, and proceeds to balance the price of 1 gallon of benzole against the price of 40 c.ft. of gas. But this will not do, for 40 c.ft. of benzole vapour of very high calorific value will permit the admixture of a large volume of inert gas, and so is equivalent to considerably more than 40 c.ft. of gas of the declared value. On the former basis taking gas at 5s. a thousand, Whitehead would debit the gas with only 2d., but this is surely painting too rosy a picture.

The attitude of the opposing school is admirably stated in the two following quotations. The first is from a report of a paper given at the Transport Congress in November, 1921.

> If we assume the crude benzole contains 127,000 B.Th.U., then, with gas at 14d. per therm, the same number of B.Th.U. in the form of gas would represent about 1s. 6d. Unless, therefore, the price obtained for these heat units in the form of benzole is such as to provide a net revenue of 1s. 6d. after deducting all the costs of recovery, including the charges on the plant, it is obviously not a commercial proposition for a gas undertaking to recover benzole.

The second is taken from one of the Technical Journals.

> We want to see the utmost benzole possible produced by the gas industry, but not at a loss. Whether a profit can be made depends on the price that can be obtained from the crude, and that profit must be in excess of what would be realized if the benzole was left in the gas and sold on the heat unit basis. This basis has given a new and easy means of calculation. Let us suppose that the removal of the benzole reduces the calorific power of what would be a 500 B.Th.U. gas by 5 p.ct., it would represent 25,000 B.Th.U. per 1000 c.ft. of gas, or 0·25 therm. Supposing from the coal used 12,000 c.ft. of gas is made per ton. By retaining the benzole, 3 therms would be obtained which sold at 11d. per therm would represent 2s. 9d. Supposing 1¼ gallons of crude are produced per ton of coal and are sold at 2s. per gallon, this would be 3s., or 2 gallons would be 4s. And the benzole extraction expenses have to be deducted, and for the protection of the mains from corrosion and meters from undue depreciation, if there is complete extraction, there must be compensating oil vapours added to the gas. This shows why so many undertakings hesitate to resume, or even to begin, benzole extraction.

Note the artless way in which the cost of manufacture of gas and the cost of distributing that same gas are ignored, while the cost of making benzole is included and certain other costs added. Is it not charming to see the way in which the gross income from gas is compared with the net profit on the benzole, and because the latter cannot, obviously, compete with the former, then forsooth, benzole recovery does not pay. It needs little consideration to see the fallaciousness of this type of argument, and it is surprising to see a similar line of reasoning in a standard work like Meade's "Modern Gas-Works Practice."

In estimating the cost of benzole recovery, the method of assessing the liability of the benzole plant in respect of therms extracted by the process is an important, in fact the most important, factor in determining whether or not the process is remunerative. The output of therms is governed by the demands of the consumer, and is not affected by the question of whether benzole is extracted or otherwise, seeing that gas is supplied to a calorific standard. If benzole is extracted the effect is not that more or less gas is sold, but that more coal is carbonized to replace the therms extracted as benzole.

In Germany, Herr Steding claims a profit of 100 p.ct. on capital outlay, and he charges the benzole with the cost of the extra coal carbonized. But we must add to this the cost of purifying the extra gas made, and deduct the revenue from the additional residuals made. Hence we arrive at the conclusion that the benzole should be charged for each therm extracted the net cost of a therm into holder.

MANUFACTURING COSTS.

In a general argument of the type put forward in this paper it is difficult to give cost figures which will meet the general case. Costs of recovery naturally vary not only as regards the particular arrangement of gas-works, which may be convenient to the erection of a benzole recovery plant, but also on the size of the plant and whether the products are refined. An important point is the difference between summer and winter load, for usually the labour employed is comparatively small, which makes it almost impossible to reduce labour costs, in periods of low throughput, to a normal level. On a large works, complete with refining plant, the cost may be surprisingly low, but on a medium size works it should be possible, at present day prices, to make crude benzole for less than 5d. per gallon.

This is divided up as follows:

	P.Ct.
Labour	31
Fuel	38
Repairs, &c.	17
Gas oil	10
Sundries	4
	100

To this must be added the value of the therms extracted. Allowing this at one therm per gallon, and taking the net cost of therm into holder at 2d., we have a total cost of 7d. per gallon. This leaves a margin sufficient to cover interest and depreciation, and yet leaves a satisfactory profit. If the crude benzole is rectified the margin is appreciably greater.

CONCLUSION.

Most of the war time objections to benzole recovery have been removed, and the resumption of the process merits serious consideration. Financial matters are of the highest importance, but they are not the only ones. Diversity of business, especially from the same raw materials, tends towards greater financial stability, and hence has a certain value in addition to the profit obtained on the benzole. Commercial success depends on economy of production, which, in turn, is the sum total of a series of contributing economies. Under present-day competitive conditions the industry must ever seek to reduce the net cost of gas, and no item in our resources can be cast aside as useless. Benzole is one of these items, and if there is a division of opinion as to the advisability of extracting it from the gas, the sooner the question is thrashed out the better. It ought to be accepted as an axiom that nothing should be burned as gas which is of greater value elsewhere.

As far back as 1916, Bagley prophesied that with the increasing competition from synthetic ammonia, the profit on benzole would approach and ultimately exceed that on sulphate of ammonia. Surely we have already arrived at that position. Sulphate production continues chiefly because we must get rid of an objectionable bye-product. Had a similar condition operated in respect to benzole we should doubtless be washing for benzole still.

But it was so easy to stop benzole washing—merely the operation of a by-pass valve! And hence it should be just as easy to resume it. An ever-growing market is available, and the tax of 4d. per gallon on imported fuel should supply a helpful stimulus. As one of the Technical Journals says:

> At the same time the rise in price obtainable is a factor that should tend to encourage greater efforts at increased benzole production. Washing for benzole extraction practised as an emergency measure during the war has fallen into desuetude. Is the rise in price sufficient to attract attention anew to that means of supplementing production?

It is the object of this paper to answer that question in the affirmative—or at least to put in a plea for a reconsideration of the various factors involved.

Discussion.

The CHAIRMAN (Mr. G. E. Anderson) complimented Mr. Nicholls upon having presented a paper upon a subject which was increasingly attracting the attention of the gas industry. There was some vagueness in the position to-day as to benzole extraction at gas-works. How was it that certain gas-works were able to maintain benzole extraction plant, and make a profit, while others insisted that it could not be done without incurring loss, or at least unremunerative complications to their system Naturally, both could not be correct in this, though, of course, the opinions held might easily be governed by local conditions. Mr. Nicholls had made no secret of the fact that benzole recovery was a profitable proposition, and no doubt this should provoke lively discussion. He was pleased to note that the paper dealt with aspects of the situation other than the purely economic one. The remarks upon the regulation of calorific values by means of benzole extraction were interesting, as also was the collaboration between benzole plant and naphthalene and gas-washing plant. He wished to take this opportunity of welcoming, on behalf of the Committee, a visitor whom they were all pleased to see, Mr. T. Westthorp, of Langley Park.

Mr. B. RICHARDSON (Tynemouth) spoke as one well acquainted with benzole plant, and endorsed Mr. Nicholls' statement regarding the poor quality of gas during 1915 to 1918. Much of this had been due to the quality of the creosote oil which was then universally employed as a stripping medium. There had been occasions when steam had had to be applied to wagons before the creosote oil could be induced to run out. It thickened quickly, and its stripping qualities decreased; and the efficiency of the benzole recovery suffered accordingly. Technical and chemical supervision had been at a minimum during the war, and it was no small wonder that benzole plant was afterwards scrapped. In medium-sized works, the process was later carried out by rule-of-thumb methods without chemical control. To-day, conditions had changed, new plant having in many cases replaced old war-time plant. This new plant was capable of running a benzole process efficiently and at a profit. One matter of importance in this connection was the growth of the vertical retort system, which was now used to produce more than half the gas manufactured in this country. Steaming the charge considerably lowered the calorific value, and most of the vertical retorts produced gas of from 450 to 475 B.Th.U., so that, for benzole extraction purposes, the gas would have to be raised to about 500 B.Th.U. Thus vertical retorts did not show to the best advantage for calorific values above that figure. Apart from the factor of paraffin in vertical gas, benzole extraction could not be practised on vertical gas supply so well because both the quality and the quantity of the gas would not stand the reduction. When benzole extraction was taken up, the process used, he thought, would not be an oil washing one. A method employing a form of charcoal would ultimately be adopted. Though the initial cost was high, it was simple, cheap to run, and efficient; and supervision charges were low. In conclusion, he wished to touch upon Mr. Nicholls' remarks regarding Boys calori-

meters. In recent tests with which he (the speaker) had been acquainted, a difference of only 1·5 B.Th.U. had been recorded.

Mr. H. REID (Newcastle) said that no doubt each undertaking would have to consider the matter from the point of view of their own particular plant. He could not, however, subscribe to the sentiment of the "Commercial Motor" that gas companies were going to take an easy course. They were aware that there was money in benzole extraction, and they did not intend to treat the subject indifferently. The public required a certain number of therms, and gas concerns set out to make them. If, however, they extracted (say) 5 p.ct. of those therms, then they would have to make up the deficiency. It might be possible to carry this out, with profit, during the summer time, but difficulty would be met with in winter peak loads, and work might become unremunerative at much higher cost.

Mr. L. H. SENSICLE (Newcastle) said that they must all agree that benzole recovery should be made to pay. It was perhaps not understood where the profit upon benzole came in. He looked upon the value of the therm as the value of the gas into the holder. Therm for therm, the distribution of gas was much more expensive than the distribution of benzole. On the subject of the Boys calorimeter, he agreed with Mr. Richardson. He could not see why they could not get within ½ B.Th.U. between two tests on the same calorimeter.

Mr. J. H. RACE (Sunderland) suggested that the crux of the whole matter was whether the process would pay, and no doubt just after the war it did not. If they were going to provide benzole in liquid form, they would have to satisfy the community that they were supplying what was needed. Benzole was equally as good as petrol as a fuel for internal combustion engines. There was the difficulty, however, that benzole had to be used at higher compressions than were needed for petrol; and this fact should be given serious consideration.

Mr. T. WESTTHORP (Langley Park) thanked the Committee for having invited him to listen to a most interesting paper. He had had some experience of benzole extraction in coke oven gas plant, and he was interested in Mr. Richardson's remarks regarding future processes and the possible use of charcoal as an absorbing agent. It doubtless had both advantages and disadvantages It should be remembered that there must be freedom from tar-fog. As to the absorbing capacities of blast furnace oil, creosote oil, and gas oil, the last-named had perhaps greater absorptive capacity than had creosote, but it did not well retain tarry matter and pitch. If water got into the oil, there would be considerable trouble. As far as the gas industry was concerned, he was told on good authority that, with vertical retorts, benzole recovery was not a sound proposition. By far the greater proportion of benzole was used, he thought, for motor purposes, and therefore the question of the presence of paraffin need not trouble them. As to whether benzole was the equivalent of petrol, this was largely a question of price. If they gave to the motorist a concession of (say) 2d. or 3d. per gallon, and they maintained the quality, the motorist would find that benzole was a wonderful fuel at the price. Most gas men would think that benzole extraction had a future before it. He himself was surprised that benzole recovery had not been re-adopted long before now.

Mr. H. B. KENDRICK (Carlisle) said that benzole extraction meant in the long run a greater amount of coal being used, and consequently a greater amount of coke being made. Already this was a drug on the market.

Dr. W. B. DAVIDSON (Newcastle) said that things had altered since the war, and had become much more normal. The only difficulty of benzole recovery was in connection with vertical retorts and steaming. In times of war, it was practically a duty to extract benzole. Even now, with a concession of 4d. per gallon, it could be very profitable all round to extract benzole from vertical retort gas, with benzole at 1s. 6d. per gallon and with gas into holder at 6d. per therm. An item which Mr. Nicholls had not stressed in computing his costs was that of capital charges. This was exceedingly high in some cases, amounting to as much as 50 p.ct. of the selling price; and this should be taken into consideration. He did not think the activated carbon process was making much progress, though they were experimenting with it in London. As to gas engineers taking an easy course, and not making benzole, he thought that, if large works were making a net profit of only a few thousands a year, they were in duty bound to increase this, and benzole was one way. It was a good calorific value regulator, and he was surprised that more gas engineers were not convinced of its advantages in this respect. He thought that it was a better policy to extract (say) 1½ or 2 gallons per ton rather than extend the making of carbon monoxide. It was better to "go the whole hog," and refine spirit rather than dispose of it as crude.

THE AUTHOR'S REPLY.

Mr. NICHOLLS, replying to the discussion, said that he had been careful not to say too much about the stripping of vertical retort gas. For works concentrating upon motor spirit, he too agreed that the presence of paraffin was not a serious matter. He had suggested generally that the return for a therm as benzole was much greater than that for a therm of gas, and it was a question as to whether it would pay them to make less gas, but of higher quality, and recover benzole. He looked upon benzole plant as a reserve of therms in times of peak loads. He was sorry that the distribution men had had nothing to say in the discussion, for the recovery of benzole had much influence on distribution. He was anxious to know their opinion regarding stripped gas and unstripped gas. He was pleased to see that Mr. Westthorp had supported benzole extraction, particularly from a financial point of view. It would do much to pursuade gas engineers to recover benzole.

DIRT IN COAL: ITS INFLUENCE ON CARBONIZATION.

By W. E. PLEVIN, B.Sc., Shift Engineer, Blackpool Gas-Works.

[A Paper read before the North of England Gas Managers' Association (Auxiliary Section), Nov. 30]

The total ash content of a coal is made up of ash from two sources First, there is the ash due to finely divided mineral matter intimately mixed with the pure coal substance itself, and which cannot be separated from it except the coal be crushed to a very fine degree Such ash is termed inherent or "fixed" ash, and the amount present in coal from a particular seam shows little variation. Secondly, there is the ash derived from dirt occurring in the seam as bands, partings, &c., and from the shale, slate, or stone constituting the roof and floor of the working. Such ash is termed extraneous or "free" ash; and while the proportion in the raw coal dispatched to the pithead depends to a great extent on the manner in which the seam is worked, the percentage remaining in the coal is determined by the efficiency of the cleaning operations to which the raw coal is subjected. Effective removal of the dirt means a considerable reduction in the ash content of a coal, and, though the picking belt enables the larger pieces of dirt to be removed, it is generally unsatisfactory, especially when dealing with small and friable coals. Increasing use is now being made of the various types of special coal cleaning plant available.

DRY CLEANING PLANT.

Advantage was taken of an opportunity of inspecting a dry coal cleaning plant, owned by a large Colliery Company in Co. Durham, to sample this dirt, with the object of ascertaining something of its nature and the influence it exerts on the carbonizing properties of a coal, particularly from the gas-making standpoint. The plant is used for cleaning coal from two collieries, which for the purpose of this paper can be referred to as "A" and "B." After preliminary grading at the separate collieries, the coal passing the 2-in. screens is sent down to the plant for treatment, and the refuse from the two pits was sampled separately. A short investigation showed certain differences in the two samples; and, though it is not intended, since no opportunity has occurred of testing further samples, to say that the figures obtained will apply generally, it is not unreasonable to expect figures of the same order. Much will depend on the age and nature of the seam and its adjacent strata.

In appearance the two samples were very similar; the refuse consisting mainly of hard soapy shale, together with a fair amount of soft black shale and stone. The samples were crushed to pass a ¼-in. mesh screen, and after analysis were subjected to a carbonizing test in a plant carbonizing a charge of 2·24 lbs. The resulting gas was purified in the usual manner, tested for calorific value, and analyzed. The figures obtained are shown in Table I. As the actual refuse sampled contained a very small percentage of coal adhering to pieces of shale and pyritic matter, allowance is made for this in calculating the figures for dirt. In future the term "refuse" will be taken as referring to the actual refuse as sampled, and "dirt" to denote the coal-free material.

The analysis shows the dirt to contain an appreciable percentage of volatile matter. This has generally been considered to be water of constitution from hydrated salts, together with a certain amount of carbon dioxide derived from the breaking-down of carbonates, but it is subsequently shown that it must contain a fair proportion of organic material from the decomposition of bituminous substances. It is interesting to note that only about 75 p.ct. of the dirt present in a coal would manifest itself in the ash figure. An objectionable feature is the very high sulphur content when compared with the normal figure of (say) 1 p.ct. in a good-quality gas coal. This is accounted for, to some extent, by the sulphates in the shale, &c.; but the amount derived from this source is probably very small. It is mainly due to the concentration in the dirt of heavy pyrites. It will be noted that an addition of 10 p.ct. of dirt to a coal would mean an increase of approximately 50 p.ct. in the sulphur content, and therefore the use of cleaned coal offers a decided advantage where the purifying capacity of a works is limited.

The carbonization of the dirt results in a comparatively good yield of a gas which, while deficient in hydrocarbons and containing a fairly high percentage of inerts, has a surprisingly

TABLE I.

—	Refuse.				Dirt.			
	Colliery "A."		Colliery "B."		Colliery "A."		Colliery "B."	
	P.Ct.	Lbs. per Ton.	P.Ct.	Lbs. per Ton.	P.Ct.	Lbs. per Ton.	P.Ct.	Lbs. per Ton.
Proximate analysis—								
Moisture	1·30	29·12	1·36	30·46	1·39	30·64	1·38	30·88
Ash	75·13	1682·91	67·21	1505·50	78·91	1766·55	72·44	1622·06
Volatile matter	15·08	337·79	16·84	377·22	14·09	315·58	15·51	347·31
Fixed carbon	8·49	190·18	14·59	326·82	5·61	127·23	10·67	239·75
	100·00	2240·00	100·00	2240·00	100·00	2240·00	100·00	2240·00
Carbon dioxide	1·910	42·78	1·580	35·39	2·015	45·12	1·724	38·61
Sulphur	5·424	121·40	5·473	122·60	5·639	126·33	5·853	131·07
Carbonization—								
Residue	17·9 cwt.	2004·80	17·3 cwt.	1937·60	18·1 cwt.	2023·78	17·6 cwt.	1966·20
Sulphur in residue	3·034	67·91	2·651	59·39	3·144	70·39	2·802	62·76
Sulphur in crude gas	2·390	53·49	2·822	63·21	2·495	55·94	3·051	68·31
Yield of gas (purified)	4450 c.ft.	197·53	5330 c.ft.	230·12	3975 c.ft.	185·54	4655 c.ft.	216·06
C.V. of gas, B.Th.U. per c.ft.	370	..	397	..	360	..	382	..
Gaseous therms, yield per ton	16·46	..	21·16	..	14·23	..	17·78	..
Analysis of gas—								
CO_2	10·2	52·57	9·1	56·15	11·8	54·29	10·9	58·85
O_2	2·9	10·84	2·1	9·34	3·3	11·02	2·5	10·14
C_nH_m	1·5	7·30	1·7	9·91	1·1	4·62	1·2	6·12
CO	19·6	64·19	19·4	76·08	21·9	64·05	22·2	76·18
CH_4	9·7	18·37	12·0	27·20	6·5	10·93	8·4	16·36
H_2	46·4	12·49	46·4	14·96	45·2	10·88	44·2	12·45
N_2	9·7	31·77	9·3	36·48	10·2	29·75	10·6	36·46
	100·0	197·53	100·0	230·12	100·0	185·54	100·0	216·56

high calorific value, yielding on the therm basis about 16 therms per ton.

The residue (it could hardly be called coke) from the carbonization was soft, dirty, and readily crumbled, very little actual caking having taken place; and it is in the presence of this material in the coke that the deleterious effect of dirt in the coal is mainly felt. The tendency of the coke to fracture along lines containing the dirt results in small nuts and the production of large quantities of very dirty breeze, the disposal of which would be difficult. Approximately 50 p.ct. of the sulphur was retained in the residue, the remainder having been driven off into the gas as sulphuretted hydrogen and other sulphur compounds.

TABLE II.

—	Colliery "A."		Colliery "B."	
	Lbs. per Ton.	P.Ct. (Vol.)	Lbs. per Ton.	P.Ct. (Vol.)
Total CO_2 in the gas	54·29	..	58·85	..
Amount of CO_2 derived from carbonates	45·12	9·8	38·61	7·1
Therefore CO_2 in excess of that from carbonates	9·17	2·0	20·24	3·8
CO in the gas	64·05	21·9	76·18	22·2
Consider the reactions— $H_2O + C \rightarrow CO + H_2$ (1) $2H_2O + C \rightarrow CO_2 + 2H_2$ (2) to give the above amounts of CO and CO_2.				
Then H_2 from reaction (1)	4·57	..	5·44	..
And ,, ,, ,, (2)	0·83	..	1·84	..
Total H_2 from reactions	5·40	22·5	7·28	25·8
Total H_2 in the gas	..	45·2	..	44·2
Therefore H_2 from organic matter	..	22·7	..	18·4

TABLE III.

—	Colliery "A."		Colliery "B."	
	P.Ct. (Vol.)	P.Ct. (Vol.)	P.Ct. (Vol.)	P.Ct. (Vol.)
CO_2 from carbonates—				
CO_2	9·8		7·1	
		9·8		7·1
Water gas (free from N_2 and O_2)—				
CO_2	2·0		3·8	
CO	21·9		22·2	
H_2	22·5		25·8	
		46·4		51·8
"Carbonization" gas (free from inerts)—				
C_nH_m	1·1		1·2	
CH_4	6·5		8·4	
H_2	22·7		18·4	
		30·3		28·0
Inerts from air, &c.—				
O_2	3·3		2·5	
N_2	10·2		10·6	
		13·5		13·1
		100·0		100·0

The gas resembles in certain respects both water gas and coal gas, and may, in fact, be regarded as a mixture of the following gases:

1. Carbon dioxide derived from the breaking-down of carbonates in the dirt.
2. Water gas derived from the action of moisture and water of constitution of silicates, &c., upon carbon of the organic matter.
3. "Carbonization" or "organic" gas composed of hydrocarbons and hydrogen from the decomposition of humic or resinous matter from the adjacent seam.
4. Inerts from the air; oxygen and nitrogen.

The probable distribution of these gases in the mixture can be arrived at and is shown in Tables II. and III. It would appear that the presence of dirt in a coal causes a kind of self-steaming effect in the retort. The extent to which this reaction takes place is indicated by the large percentage of "water gas" in the mixture. It is probable that the simultaneous evolution of carbon dioxide from the carbonate serves to shift the water gas equilibrium and so depress the reaction

$$2\,H_2O + C \rightarrow CO_2 + H_2$$

and thus the ratio $CO_2 : CO$ is somewhat less than is usually the case. It would also seem that the steam and hydrogen present serve to protect the olefines in the pyrogenetic decomposition of the organic matter, and thus the proportion of unsaturated hydrocarbons to methane is high.

Thus in the carbonization of a coal, the dirt does contribute to the gas yield; and while the gas make per mouthpiece would show a falling-off where the coal contains much dirt, the decrease would not be so great as might at first be expected. Therefore it is wrong to calculate that, in cleaning a coal, entirely inert matter is removed.

In conclusion I wish to thank Mr. F. P. Tarratt and Mr. L. H. Sensicle, of the Newcastle and Gateshead Gas Company, for permission to publish this work.

Discussion.

The CHAIRMAN (Mr. G. E. Anderson) said the experimental figures of the process of carbonization were surprising in that it was not generally appreciated what a high calorific value the volatile matter in the dirt had.

Mr. L. H. SENSICLE (Newcastle) said that Mr. Plevin's figures gave them some indication of the benefits which offset the difficulties and costs of cleaning coal.

Mr. WESTTHORP (Langley Mill) averred that the arguments in favour of clean coal were 100 p.ct. good, both from the practical and from the scientific point of view. From the economic standpoint, however, there was cause for disappointment in that people would not pay for clean coal, in spite of advantages which had been demonstrated again and again. Mr. Plevin had shown that dirt contained some 30 to 40 p.ct. of volatile matter which did not finally show itself in the ash. He thought that the effect of ash in bye-products and on refractory materials was not of negligible importance.

Mr. J. H. RACE (Sunderland) remarked that colliery people were

not lessening their efforts to remove dirt from coal, but it was nevertheless reassuring to know that, when gas engineers charged some 20 or 30 tons a day of inert matter into their retorts, part of this made therms. He was pleased to note the distinction between dirt and inherent ash.

Mr. PLEVIN, replying briefly to the discussion, said that he had simply tried to present a few new facts, though, of course, costs of cleaning had already been published, and the effect of dirt on coke. There was no doubt that the cleaning of coal paid; but every gas company did not relish the idea of paying for this cleaning.

OPENING OF GLOVER-WEST VERTICAL RETORT INSTALLATION AT PEEBLES.

A Century of Gas Service.

Reference was made in the "JOURNAL" for July 31 last to the installation of Glover-West vertical retorts at the works of the Peebles Gas Department. The opening ceremony, which was also the celebration of the centenary of the introduction of gas into Peebles, was held on Saturday, Nov. 23.

The visitors and officials gathered inside the buildings, which have undergone a vast change. The former horizontal retorts have been removed, and there is a great vacant space, the vertical retorts being situated at the top end of the building, and their construction being such that little space is necessary. Near to the engine house was erected a small platform, on which were gathered Provost and Mrs. Anderson, Bailie Todd, Capt. J. Miller Cunningham, and Mr. J. Walter Buchan, Town Clerk.

Provost ANDERSON, in the course of his address, said that this was an interesting occasion. They were met together to celebrate the centenary of the Peebles Gas-Works, and the official opening of the vertical retorts which had recently been constructed by West's Gas Improvement Company, Ltd.

EARLY DAYS OF GAS IN PEEBLES.

A meeting of the inhabitants was held on Jan. 9, 1829, with John Hay, of Smithfield, in the chair. It was resolved to form a Gas Light Company, and a Committee was appointed to report. The capital of the Company was £700, but this was not enough to meet the cost of erection of works, and was increased to £970. West Country coal was used, and it had all to be driven in carts from the colliery. To begin with, gas was only made during ten months of the year, and the public lamps were lit for only 119 nights. For the first year, 1829-30, there was no dividend, for 1830-31 it was 5 p.ct., and for 1831-32 4 p.ct. In 1833, it was decided to make and supply gas all the year round. In 1835, the total consumption of gas for the year was 175,719 c.ft., and the price charged was 13s. per 1000 c.ft. For a year or two after this the Company did not do well, and in 1837 it was decided to let the works. John Paterson was the successful offerer at £51 per annum. He was an ironmonger in the town, and did his best to make the scheme a success. The let to him continued till 1844, and after that the Company made progress, and paid dividends regularly.

In 1849, the price of gas was reduced to 12s., and in 1853 to 10s. The annual consumption had then risen to 736,000 c.ft. In 1854, the dividend was 7 p.ct., and in 1856 the capital was increased to £1500. With the increase in the consumption the price of gas came down. In 1859, it was 8s. 9d., and the following year 8s. 4d. The coming of the railway was a great boon; trade immediately improved in the town, and the consumption of gas in 1861 was 903,000 c.ft. The dividend rose to 8 p.ct., free of tax, in 1865, and in 1866 the capital was increased to £2000; 10 p.ct. was paid in 1869 and 12 p.ct. in 1870. In 1871, the capital was increased to £3400, and the following year the dividend on the increased amount was 5 p.ct. It rose to 8 p.ct. in 1873, and in 1876 the capital was further increased to £4000. It was increased again in 1881 to £6000. From that date till 1897 the dividend ranged from 8 to 10 p.ct. In 1889 the Town Council took over the gas-works, and the Company was dissolved. The annual consumption was then 13 million c.ft. The cost of the transfer to the Council was about £11,000.

NEW WORKS.

New works were soon necessary, and in 1905 the present buildings were erected. These were skilfully designed and well adapted by the late Mr. Alexander Bell, then Manager, at a cost of £25,000. Automatic lighting was introduced in 1913, and they were now to witness the opening of the new vertical retorts. With the coming of electricity into the burgh, they had been compelled to take this means of reducing the cost of production to meet the competition of electric power and light. It was estimated that they would use 2000 tons less coal, and labour would cost £750 less. On those two items they would save £3000, but, on the other hand, they got less coke, which meant a reduction of that amount by £500—a round saving of nearly £2500. They had already reduced the price of gas by 10d. per 1000 c.ft. It was now 4s. 2d., and they hoped under Mr. Farquhar's management still further to increase the consumption and reduce the price. In this connection it was interesting to remember that the late Mr. William Young, of Priorsford, who was a Director of the Peebles Company at the time of its transfer to the Council, was one of the pioneers of the system of vertical retorts. He showed how to distil shale in vertical retorts for the production of oil and ammonia, and his ideas were adapted to the carbonization of coal for the production of illuminating gas by his fellow-workers, Messrs. Samuel Glover and Thomas Glover. The present annual consumption of gas in Peebles was about 55 million c.ft.

At the conclusion of Provost Anderson's remarks, Bailie TODD called upon Mrs. Anderson to perform the opening ceremony.

Mr. RONALD B. GLOVER, Assoc.M.Inst. Gas E., A.M.I. Mech.E., of West's Gas Improvement Company, proposed a vote of thanks to Mrs. Anderson.

GAS-WORKS POWER PROBLEMS.

By A. J. CRUISE, of the Cardiff Gas Light and Coke Company.

[From a Paper before the Wales and Monmouthshire Junior Gas Association at Cardiff, Nov. 16.]

The power for the different plants comprising a gas-works may include steam, electricity, compressed air, gas, and hydraulic power, or any combination of these. Also the location of the various processes requiring power many result in the adoption of isolated units rather than the central station unit. Having had considerable experience with isolated units, in the majority of cases steam driven either from adjacent boiler units or from boilers some considerable distance from the prime movers, I have come to the conclusion that to keep pace with our competitive industries, this haphazard and scattered power production and utilization can and must be abolished; and from the economic point of view the replacement of these by units utilizing the available waste heat of the carbonizing plants will undoubtedly result in a considerable increase in the over-all efficiency of the works.

Power plant which in my opinion is most suitable to gas-works purposes comprises either back-pressure turbines or engines, or steam extraction turbines or reciprocating engines. Before we can really appreciate the economies which can be effected by the installation of back-pressure or extraction plants, however, we must comprehend the manner in which steam is utilized on the gas-works generally. Owing to the diversity of types and combination of types of carbonizing and auxiliary plants in operation at the various works, it is impossible to dogmatize about the actual figures relative to the installation of these power plants without knowing exactly the local conditions appertaining to each installation.

However, any medium-sized gas-works must use steam in two distinct ways—first, for the production of power, and secondly, for what we term process work.

Plants Using Process Steam on a Gas-Works.

—	Pressures in Lbs. per Sq. Inch.	—
1 . . .	15–30	Steaming of vertical retorts
2 . . .	60–80	Manufacture of water gas or carburetted water gas
3 . . .	15–30	Manufacture of sulphate of ammonia
4 . . .	15–60	Works heating and other bye-product plants

The application of steam for the production of power on a gas-works may be in any of the following ways: Directly in steam engines or turbines; and as a prime mover for electrical generators, compressed air engines, and hydraulic engines. It is upon the correct balancing of the supply of steam for these various needs of power and process work that the design of the extraction or back-pressure plant depends.

ADVANTAGES OF CENTRAL POWER UNIT.

With regard to the steam required for process work, it is evident at the outset that, for plants such as vertical retorts and carburetted water gas units, the demand will be nearly constant, and the pressures will also require to be constant. When we come to power requirements, however, the steam demand is obviously going to fluctuate considerably from hour to hour according to the machines and engines in operation. With isolated power unit, this is more noticeable than with a

central unit, for the shutting-down of a particular set of engines may decrease the consumption of steam from the boiler by anything between 30 and 100 p.ct., varying with the size of the engines and the length of the stop. In addition to this, the fact that steam may be used for auxiliary prime movers such as compressed air or hydraulic plants, or for high-pressure gas compressors, results in the over-all efficiency being considerably lower than that which might be obtained, due to the low thermal efficiency of the local boiler plants and of the steam engine.

On the other hand, if a central power unit utilizing steam for the generation of electrical power were installed, the thermal efficiency of the larger unit would be much greater than that of the smaller ones; and in utilizing this energy for motive power, the only other losses would be those due to conversion and transmission. These losses are in all cases much smaller than those experienced in the small isolated units. Even if the latter are linked up by steam mains, there is always an immense loss due to condensation, as well as to the difficulty of working various parts of the plant at different pressures.

Reducing Thermal Losses.

The great loss in the steam prime mover is that due to the heat left in the exhaust steam—mainly what we term the latent heat of the steam. This can be partly recovered in a condenser or in a feed-water pre-heater; but a much more efficient manner of minimizing the loss is to use the exhaust steam for process work. We can accomplish this in either of two ways, according to the requirements of power and process steam. The first is to have the steam entering at a pressure sufficiently high to allow a drop in heat to an exhaust pressure so that it fulfils the needs of the plants. Secondly, if more than one pressure is required for process work, it is best to employ an engine or turbine in which the necessary heat drop to provide the electrical power is accumulated over a number of stages in the turbine. At each of these stages, corresponding to the different pressures at which steam is required for process work, means are provided for the extraction of sufficient steam to meet the demand at that temperature and pressure.

This type of turbine demands a fairly high initial pressure of steam, and also a fair superheat. With a waste-heat boiler, there should be no difficulty in producing a pressure of 180 to 250 lbs. per sq. in. on the boiler stop valve. The whole of this steam could be led to a turbine which would expand it down to 80 lbs. per sq. in. and allow an extraction of sufficient steam to supply process plants, such as the C.W.G. units, at 75 lbs. per sq. in., and provide a steam supply for exhausters or boosters, water gas blowers, and coal and coke handling steam then enters the low-pressure section of the turbine, where it is expanded to the terminal pressure of 25 lbs. per sq. in. Exhausting at this pressure, a steam supply is available for steaming vertical retorts for sulphate of ammonia plants, and for general heating purposes and feed water heating. The electrical energy developed by the turbine provides an easily transmitted power supply for air or gas compressors, boosters, water gas blowers, and coal and coke handling plants, or for purification and bye-product recovery installations using power for elevating, conveying, crushing, grading, and drying purposes. As most of these plants run intermittently, and the carbonizing equipment is in the main also of a similar character, the electrical load can become well balanced, with the result that the power output, and consequently the steam input, can be established under constant conditions.

If the exhaust pressure is fairly high, existing steam driven units can be rendered much more efficient by installing an exhaust steam turbine. Another manner in which large steam losses may be avoided is by the installation of a steam accumulator. The accumulator makes possible the absorption of all fluctuations between demands for power and demands for process steam, regardless of when and where they occur in the works. It prevents losses from safety valve blow-offs, and keeps the evaporation rate of the boiler constant.

A number of relatively small power units and some process plants may be fed from one boiler plant. Without an accumulator, fluctuations in the demand for power or process steam result in variation in the pressure of the system, and allow serious losses through the low-pressure system. With an accumulator, the whole gamut of fluctuation is transmitted to the accumulator, and the boiler supply and the power and process demands can be adjusted with a minimum of trouble. The principle of the Ruth accumulator is to limit the normal flow of steam from the boiler so that the pressure in the latter is kept constant, and to supplement the pressure beyond this limiting device. Hot water absorbs steam energy at a greater rate per pound with low-pressure steam than with high-pressure steam. Since by using low-pressure steam we can increase the capacity per pound of water contained, it is economical from the point of view of both construction and operation to instal a low-pressure accumulator working at a pressure below that of the boilers.

Some of the more important losses in steam transmission are due to the inefficient layout of the main, and to the fact that the pressures often employed result in steam being too wet. The efficiencies of continuously running turbines or reciprocating engines, where a condenser is not practicable, can be considerably increased by the installation of feedwater heaters.

Mr. W. E. Crowley (the President) asked if there would be any undue condensation from working at low pressures after the accumulator.

Mr. C. S. Thane (Newport) asked for further details of the exhaust steam turbine. Also, was the accumulator system adaptable for fairly large areas, and was any trouble experienced through "priming"? He agreed that worn steam nozzles for producing draught for Lancashire boilers used more steam than a small turbo blower.

Mr. H. S. Bartlett (Cardiff) inquired whether, in a well-laid-out works with regularly inspected isolated units, the cost of centralization of the plant would be an economic proposition.

Mr. B. J. Bell (Cardiff) inquired as to the position and function of the accumulator. Did the system of centralization suggested take advantage of the waste heat from retort houses?

Mr. A. G. Mogford (Cardiff) observed that the system suggested the majority of the plant being electrically driven. Would the use of an accumulator increase the condensation losses in process plants?

The Author's Reply.

Mr. Cruise, in reply to the question raised by Mr. Crowley, said that since the centralization system was dependent on the amount of plant working, power and process demands would fluctuate in direct proportion to the supply, thus maintaining a constant ratio of heat input into the boilers, and power and process steam output to the plant. There would be no extreme condensation losses due to the low-pressure mains carrying the steam to the process plants, if they were well lagged and designed. Further, the steam, by reason of its throttling through the reducing valves, would be drier on the low-pressure systems, and so render its transmission more efficient. Regarding the exhaust steam accumulator, this was designed to utilize the exhaust steam from continuously running reciprocating sets; and the steam was converted into electricity by turbine. Provided proper precautions as to layout and design were observed, the steam accumulator would work efficiently over fairly large areas. The design of the distribution nozzles on the steam inlet to the accumulator was such as to preclude any priming difficulties. As to cost of centralization in well-kept and efficiently maintained isolated plants, the increase in efficiency would not pay for the cost; but in plants where the existing units were antiquated or obsolete, the cost would easily be covered by the profits on working at an increased efficiency. Replying to Mr. Bell, Mr. Cruise said the accumulator was placed in the system to absorb the fluctuations in pressure on the low and high pressure lines which arose from intermittent demands for steam, and to augment the supply from the boilers in the event of peak loads occurring suddenly. The system of centralization suggested had, as its basis, the supply of waste heat from the carbonizing plants, and, by its utilization in back-pressure or extraction plants, the production of the whole of the power necessary to run the works, and subsequently the supply of sufficient steam at low pressures to satisfy the process demands of auxiliary plants. Referring to Mr. Mogford's question, he would say that the system depended upon full advantage being taken of the supply of cheap power employing electrical drive as far as possible. The condensation losses would not deviate to any appreciable extent from the normal unavoidable losses.

Votes of Thanks.

Mr. C. B. Felton (Newport) proposed that the best thanks of the meeting be tendered to Mr. Cruise for his paper; and this was seconded by Mr. Mogford, and carried unanimously. A vote of thanks to the Chairman and Directors of the Cardiff Gas Light and Coke Company was proposed by Mr. S. E. Brett (Rhondda), and seconded by Mr. J. H. Canning, Junr.

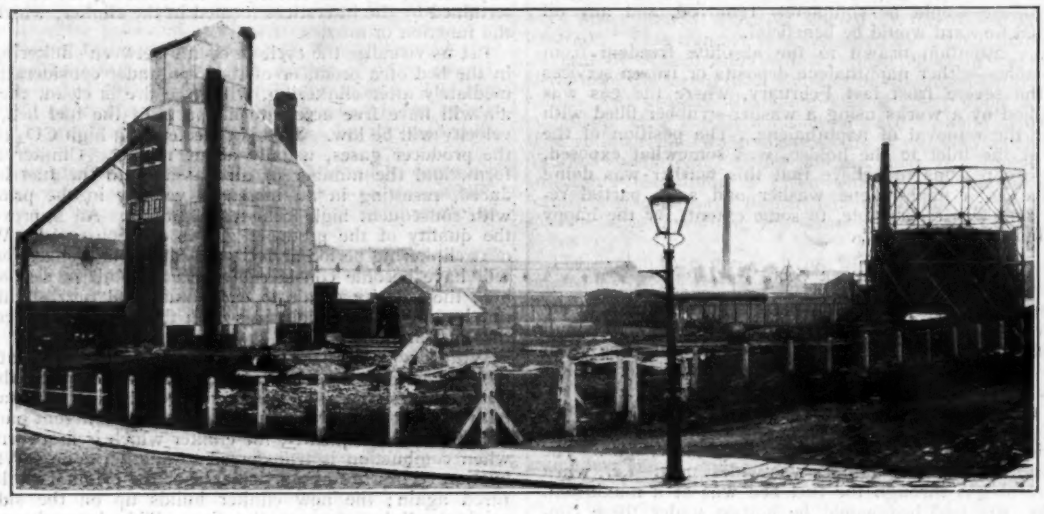
The Hon. Secretary (Mr. H. S. Bartlett) announced that an invitation had been received from Mr. Davir Muir, of Treforest, to visit the works there, for the purpose of inspecting a new gasholder which was under construction.

The invitation was readily accepted by the members; and arrangements will be made to inspect the holder in January next.

International Illumination Congress.—It has been decided that the next International Illumination Congress is to be held in Great Britain in 1931. All interested in the cause of better lighting are uniting to render the congress an outstanding success. The National Illumination Committee of Great Britain, in co-operation with the Illuminating Engineering Society, will be responsible for this important event. Several Committees are already at work on the arrangements, fuller particulars of which will be announced in due course. The congress, which will take place during the period Sept. 3 to 13, 1931, will be combined with a *voyage d'étude* of places of interest in England and Scotland, so that other cities besides London will share in the work of the congress. Papers dealing with the most varied aspects of lighting will be presented, and these will be grouped so as to ensure that topics of special local interest are dealt with at each centre. The congress will be followed by the technical meetings of the International Commission on Illumination, which will be held in Cambridge during Sept. 13 to 19. The Hon. General Secretary of the congress is Col. C. H. Silvester Evans (c/o The Illuminating Engineering Society, 32, Victoria Street, London, S.W. 1), to whom all communications should be addressed.

CONTINUOUS VERTICALS FOR SMALL GAS-WORKS.

Glover-West Installation at Earby.



The district served by the Earby and Thornton Gas and Lighting Company, Ltd., within the West Riding of Yorkshire, is just on the northern fringe of the Lancashire industrial region. In 1926, the original works having become obsolete, it was decided to erect a complete new works, there being no room for further extension on the old site. Very careful consideration was given to the several types of carbonizing plant available, particularly in view of the small capacity of the works, the annual make having risen, under the direction of Mr. H. W. Kaye, the Engineer and Manager, from 30 millions in 1920 to about 39 millions.

The decision went in favour of the adoption of Glover-West vertical retorts, and this installation is an excellent example of the application of continuous verticals to small works. On March 13, 1927, the old works were shut down, and since that date the whole of the demand has been met by the vertical retorts. The change-over was effected without the slightest hitch. The flexibility of the plant has been proved to be such that no difficulty is experienced in adjusting the production in the four retorts to the fluctuating requirements of the district.

The daily capacity of each retort is 60,000 c.ft. of gas at 500 B.Th.U., equivalent to 78 therms per ton, or 62,500 c.ft. and 85 therms at 475 B.Th.U. when carbonizing good Yorkshire coals. The bench is complete with a shell for the subsequent installation of two further retorts, and the retort house building is constructed with a sheeted gable end, so that extensions beyond the six retorts can be carried out with a minimum of cost.

The retort bench is encircled by a West lip-bucket conveyor, receiving coal from road vehicles and elevating coal and coke to retorts and producers. Coal bunkers of 48 hours' capacity are placed above the retorts with a shoot to direct surplus coal to the yard. The whole of the operations within the retort house, coal feeding to the plant, barrowing coke to the yard, attention to the producers and retorts and to boilers and exhausters is performed by one man per shift. The auxiliary plant of the new works comprises Holmes water-cooled condensers, Livesey washer and Holmes rotary washer of 500,000 c.ft. daily capacity, and a Bryan-Donkin exhauster of 15,000 c.ft. hourly capacity. The tar, liquor, and water pumps are by Messrs. Evans, of Wolverhampton, and a new Lancashire boiler, 26 ft. by 7 ft. 6 in. diameter, for a working pressure of 100 lbs. per sq. in., has also been installed.

In order to carry out these extensions, the capital of the Company was doubled, the price of gas remaining the same. In spite of this, the full dividends have been paid, and the Directors are pleased to announce a reduction of 3d. per 1000 c.ft. of gas to date from Jan. 1, 1930, when the new declared value of 475 B.Th.U. will come into force. In the current year it is anticipated that 45 million c.ft. will be sold, and the new works are capable of easy extension to an annual demand of 150 millions.

GAS DRYING AND PRODUCER PRACTICE.

By F. FIRTH, A.I.C, Chief Chemist to the Leeds Gas Department.

[From a Presidential Address before the Yorkshire Junior Gas Association, Nov. 16. A further section of the address, dealing with benzole recovery, was published in the "JOURNAL" for Nov. 27.]

GAS DRYING.

In a paper I gave before this Association in 1926—"JOURNAL," Vol. 174, p. 41—suggestions were made that the most likely method of reducing corrosion in the distribution system would be to send out dry gas. At present this is being done by a number of undertakings with apparent success. The method of dehydration which appears to be most popular is by the use of calcium chloride solution, which is employed in the ordinary washer-scrubber; probably it is because gas men are so familiar with the latter appliance that this system holds the field. Other dehydrating agents are on the market, but have not been applied as widely as has calcium chloride. Some trouble might have been expected in the parts of the washer not submerged, but, as the general opinion of all who are working these plants appears to be satisfactory, I think we may take it that any troubles experienced have been of a minor character.

FREEZING.

The other methods of drying gas, based on entirely different principles, are by adsorption, compression, and freezing. The probable weakness of the two latter methods might be the difficulty of eliminating the water fog thrown down from the gas before going forward to be re-evaporated. In regard to the cost of the freezing method, I have seen it suggested that it would be prohibitive compared with dehydration using calcium chloride; but I think this is an exaggeration.

Though it is no proof that freezing is as cheap as calcium chloride for dehydrating gas, it is employed in certain blast furnaces for that purpose. I have made a rough calculation of the amount of "cold," expressed in terms of ice, which would be required to dehydrate gas saturated at 68° Fahr. to an ultimate dew-point of 35·5° Fahr. on a daily output of 5 million c.ft. This "cold" is equivalent to 21 tons of ice—no allowance being made for radiation losses or possible "cold" exchange. I find that only one ton of coal is used in the manufacture of 17 to 20 tons of ice.

"Freezing" is rather an unfortunate term to use. It implies that the water vapour is removed as ice, which, in addition to increasing the difficulties of working, would be a waste in the expenditure of "cold;" a better term would be "chilling."

DEHYDRATION BY MINERAL OIL.

A method which suggests itself as being suitable for the dehydration of town gas is to use a washer-scrubber or Livesey washer filled with a mineral oil having a low viscosity at low

temperatures—*e.g.*, gas oil—and kept at the necessary temperature by one of the standard methods of refrigeration. The degree of dehydration necessary will depend on the season of the year, and adjustments of oil temperatures will give the necessary control. A proper selection of the oil used would prevent any serious trouble due to formation of emulsions. In addition to dehydration, this system has other advantages; the naphthalene would be completely removed, and any oil spray carried forward would be beneficial.

I had my attention drawn to the absolute freedom from district troubles—either naphthalene deposits or frozen services—during the severe frost last February, where the gas was being supplied by a works using a washer-scrubber filled with gas oil for the removal of naphthalene. The position of the scrubber, at the inlet to the holder, was somewhat exposed, and there are reasons to believe that this washer was doing dual service as a naphthalene washer and as a partial refrigerator, and was responsible, to some extent, for the happy state of affairs on the district.

Producer Gas.

I propose to put before you a few personal observations of the comparative behaviour of producers having large and small grate areas respectively, with special reference to the open step-grate type; also the important rôle played by clinker formation.

During experiments with an open step-grate producer some time ago, it was observed that variation in draught had considerable influence on the quality of the producer gas. The quality improved when the damper was widest open—*i.e.*, when the velocity of gas through the fuel bed was at a maximum. Incidentally, the fuel bed would be hottest under these conditions.

There are two schools of thought on the mechanism of the formation of producer gas. One is that CO_2 is first formed, and is converted into CO in passing through the fuel bed. The other is that a CO-CO_2 complex is formed, and the proportions of each are governed by the temperature of formation. The former theory is the one usually quoted in text-books, generally accompanied by a sketch of a producer indicating CO_2 being formed near the firebars, and at an appreciable distance up the fuel bed the change to CO is shown. This theory is difficult to accept, because the hottest part of the furnace is near the firebars, the change from CO_2 to CO is endothermic, and the hottest part of the furnace is most favourable for the conversion. Higher up the fuel bed the temperature is comparatively low.

Again, with a mechanism of producer gas formation of "CO_2-interval-CO," it is assumed that the period of time contact with the fuel in the producer has a considerable influence. My own experience does not corroborate this. With a higher air velocity through the furnace the time contact is reduced, but the ultimate quality of the producer gas is improved.

Further proof that time contact, so far as it operates in open step-grate producers, does not materially affect the quality of the producer gas is furnished by an experiment which was carried out on a West producer. A furnace was run for more than a week without clinkering. The fire was broken up at intervals, in order to maintain the necessary quantity of producer gas, but no clinker was removed. At the end of this period there was a depth of more than 2 ft. of loose clinker on the bars, thereby reducing the depth of the fuel bed by that amount. The producer gas, after the first four hours, contained about 3 p.ct. of CO_2 and then scarcely varied for the remainder of the period. This experiment also suggests that gas production is not improved by having the depth of the fuel bed greater than that necessary to eliminate any risk of by-passing primary air. For practical reasons a deep fuel bed is to be recommended.

The theory that the gas formation is a complex of CO-CO_2, or that if CO_2 is first formed it is almost instantaneously converted to CO, without any measurable time lag, helps me to interpret the results of my observations.

I think that, in producer gas practice as applied to open natural-draught furnaces, the formation of clinker is of first importance, and the velocity of air entering the furnace is determined by the interstices formed in the clinker, which assume the function of nozzles.

Let us visualize the cycle of events between clinkering periods in the bed of a producer of the type under consideration. Immediately after clinkering, when the fire is clean, the primary air will have free access to all parts of the fuel bed, and the velocity will be low. This is reflected in a high CO_2 content in the producer gases, usually about 10 p.ct. Clinker begins to form, and the number of air passages to the fuel bed is reduced, resulting in an increased velocity in the primary air, with consequent high local temperatures. An improvement in the quality of the producer gas is then observed. When the next clinkering period arrives, the clinker interstices (or nozzles) will have become considerably reduced both in size and number; the velocity of air to each individual nozzle will be at a maximum, and this coincides with the producer gas containing the least amount of CO_2.

With a wide furnace the resistances in the different parts of the fuel bed alter periodically, governed largely by the formation and resistance of clinker. The primary air, taking the path of least resistance, enters alternately different parts of the fuel bed. Consequently, the clinker which is first formed cools when combustion is transferred to another zone. When combustion recurs in any particular spot the original clinker is not fused again; the new clinker builds up on the side of the original clinker nearest the fire. This intermittent clinker formation appears to produce a friable product which is easily dealt with and is distinct from the large homogeneous types typical of the narrow furnace. The narrow producer does not lend itself, to the same extent, to directional changes in the path of the primary air through the fuel bed, and clinkering difficulties are aggravated. With a limited grate area it is necessary to prick the fire at frequent intervals. At such times there is a drop in the quality of the producer gas; also, the operation is not economical in fuel.

A recognition of the part played by clinker formation can be put to useful advantage. Generally, it will be admitted that clinker usually first begins to form on the sides and lintel of a furnace where one side is brick. Obviously, these particular places offer the least resistance to the primary air, and are getting the bulk of combustion. This proceeds until the resistance built up by the clinker formation is in excess of that thrown by other parts of the fuel bed. The path of the primary air is then deflected. After each clinkering and cleaning of the fires, the above cycle repeats itself. Does it not occur to you from the evidence that clinker persistently forming first in these particular spots indicates that the design of the furnace is imperfect, and the formation of clinker is providing the necessary adjustment for this defect? When I speak of "imperfect" it is from the gas producing, and not the structural, point of view; the latter will be influenced by factors with which I do not propose to deal.

It would appear advantageous to limit the removal of clinker from these places to a minimum, governed entirely by the capacity of the producer. Where a wide producer is in operation this can be practised, when, in addition to the better quality of the producer gas, there is the distinct gain in the longer life of the furnace linings, &c.

If the size of the producer is limited—*i.e.*, when the furnace is built in the setting—I prefer the "closed door" type, where a semi-Mond gas reaction takes place, and the clinker is easily dealt with. On the other hand, with ample grate area, I prefer the open step-grate type.

TAR WORKS EMULSIONS.

By Robert G. W. Eadie, B.Sc., F.I.C., Manager of the Provan Chemical Works.

[From a Paper before a Joint Meeting of the Scottish Junior Gas Associations in Glasgow, Nov. 9.]

In the normal process of separating the crude tar of a gas-works from the ammoniacal liquor, it is found invariably that this separation is incomplete. An intermediate layer between tar and liquor forms, which is an emulsion of water in tar. How much might be done at the gas-works in the way of separating the tar and liquor more rapidly and thoroughly as it is produced, I do not venture to state. I do believe, however, that the tar distiller would be rid of more than one worry if such a practice were adopted, for it is now well established that the ammoniacal liquor, which is ultimately destined to go down the drain or into a river, increases in toxic powers, and becomes, therefore, ever more unsuitable for such disposal the longer it stands exposed to the air and in contact with crude tar.

I have not had an opportunity of studying many of these emulsions which form with tar and liquor, but I think I am correct in assuming that the trouble is met with to a degree in all cases of crude tar and water mixings, and is probably worst of all in water gas tar. No theory as to the cause of these emulsions has, to my knowledge, been put forward; but it is probable that the free carbon present in tar may act as an emulsifying agent of the finely divided solid class. In the case of low-temperature tars, where the free carbon content is low, the trouble still persists, probably on account of the closeness of the specific gravity of the tar to that of the ammoniacal liquor.

Separation by heating and prolonged settling has been the usual way of attacking this problem. The Wikner tar de-

hydrator, described in detail at the last Joint Meeting of the Juniors here in Glasgow, has also proved effective in dehydrating by distillation tars containing up to 10 p.ct. of emulsified water. Above this figure for water content, it is possible that a modification in design would give better results. Another piece of apparatus which is being used for breaking down water in tar emulsions is the Sharples super centrifuge. This machine has been applied to separating the water from the Maclaurin low-temperature tar produced at Dalmarnock Gas-Works.

A trial run at Dalmarnock Chemical Works showed that Maclaurin tar, entering with a water content of up to 10 p.ct. could be dehydrated down to less than 2 p.ct. water. The rate of throughput of crude tar was in the region of 100 to 120 gallons per hour. The electric power used by the centrifuge was 1·48 units per hour.

On cleaning after the test, the bowl was found to contain a quantity of gummy residue. This residue was 80 p.ct. soluble in ether, and the balance 20 p.ct. appeared to be solid matter of the nature of coke dust.

Another example of the occurrence of emulsification where it is not wanted is found in the course of extracting tar acids—*i.e.*, the phenolic bodies from coal tar oils—by means of caustic soda.

Up till now we have been obliged, therefore, to accumulate this material in a separate storage until a convenient shut down period, when the bulk is taken up for special prolonged steam heating treatment, and a partial separation effected. The fact that washing in the laboratory seldom, if ever, gives such an emulsified layer has led us to investigate the probable cause of the trouble so common in the works. In this case, I think we have almost conclusive evidence that finely divided solids are the emulsifying agents.

An analysis of the emulsion shows the following content of solids:

Free carbon insoluble in organic solvents	7·1 p.ct.
Inorganic matter, chiefly lime and iron oxide. . .	2·8 ,,

Moreover, emulsified layers have been produced in the laboratory by adding traces of calcium carbonate to the caustic soda used in washing, and also by adding free carbon extracted from pitch to the oils being washed. It remains to be seen whether traces of calcium carbonate can be prevented from coming forward with the caustic soda in the works, and whether free carbon may be conveniently kept out of the oils. The latter is probably a result of transporting of oils from other works in rail tanks which have previously been used for tar. The foregoing instances are sufficient to indicate how troublesome an emulsion may be when it forms as it were of its own accord and sometimes in most unexpected places.

Most Suitable Type of Emulsion.

I shall now pass to a consideration of cases where it is a distinct advantage to have liquids in the emulsified form, and where the problem of the chemist is to produce the most suitable type of emulsion.

A considerable proportion of the oils produced from the distillation of coal tar is employed in the manufacture of general disinfectants. Many of these disinfectant fluids are prepared in such a manner as to give emulsions with water.

A simple form of plant is all that is required, and, as a rule, consists of a steam heated vessel in which an emulsifying soap solution may be prepared from a suitable fatty acid and caustic soda or caustic potash. A similar tank, not necessarily heated, is used for measuring the tar oil. Both these vessels are connected by pipe lines to a mixer in which the necessary proportions of soap and oil are agitated so as to produce a perfectly homogeneous fluid.

(1) Horizontal retort oil + rosin soap. Colour—white.
(2) Vertical retort oil + rosin soap. Colour—pink.
(3) Specially treated vertical retort oil + rosin soap. Colour —white.

Here we have a typical example of one of the problems which confronted tar works chemists in Scotland when the change-over took place from horizontal to vertical retorts at the chief gas-works. Many coal tar oils are used for the preparation of disinfectants, and a particularly large outlet for these oils lies in the direction of the sheep-dip manufacturer. For the manufacture of sheep-dip it is imperative that an oil be used which will give a disinfectant with a white emulsion. Otherwise the colour of the emulsion will be imparted to the wool, and consequently affect its market value.

The oil which some seven or eight years ago could be sold in large quantities for the manufacture of sheep-dip and to a specification stipulating only the specific gravity, naphthalene content, and concentration of tar acids, has now disappeared along with the horizontal retort. In its place the vertical retort worked on Scottish coal offers up an oil so profuse in colour-producing bodies that no sheep-respecting disinfectant manufacturer will buy it unless it has been subjected to special chemical treatment. This treatment is rather costly in the light of the fact that coke oven tar from English coal continues to give the desired white emulsions product.

With excessive amounts of soap used in the manufacture of a fluid, disinfectants result which give clear solutions in water. Many of these are on the market under all sorts of fancy trade names. For a great many purposes, however, the emulsion fluid is favoured. There may be many reasons for this preference. One in particular appeals to me as being theoretically sound and certainly worthy of note.

The Rideal-Walker Co-efficient.

As an indication of disinfectant values, a standard number is very often quoted which is known as the Rideal-Walker co-efficient. This number is determined by a bacteriological test devised by Rideal and Walker. The object of the test is to determine the strength of solution of the unknown disinfectant which will produce the same killing effect upon a standard organism as a 1 p.ct. solution of pure carbolic acid crystals. The ratio of the two concentrations is reported as the Rideal-Walker co-efficient. Using this test then, it is found that disinfectants containing a given quantity of tar acids in the emulsified form have higher Rideal-Walker co-efficients than disinfectants containing the same amount of tar acids in solution.

The explanation given of this highly satisfactory result with emulsions is that the bacteria are absorbed on to the surface of the tiny globules of tar oil in the emulsion and so attacked by tar acid in its pure concentrated form in the globule. In support of this statement, it is reported that in certain cases of severe attacks of insect parasites on cattle, solutions of arsenic would not kill the insect until used in such concentration that the cure was worse than the disease on account of the scalding which resulted; but that by incorporating an oil emulsion with the dip, complete destruction of the tick could be effected, using much less arsenic solution.

So far, I have referred only to disinfectants which form emulsions in more or less pure soft water. It is often necessary, however, for the fluid to be such as will produce a permanent emulsion in hard brackish water, or even salt sea water. In such a case, soaps cannot be used as emulsifying agents, and, as a rule, are substituted with glue, gelatin, or casein.

By means of the "Premier" mill, emulsions of creosote oil in water have been prepared, which may be boiled or frozen without suffering any change in composition; 30-50 p.ct. creosote oil in water emulsions produced in this way give the same depth of impregnation into timber as is obtained by treatment with the creosote oil itself under high pressure. Apparently, the fine state of division of the creosote oil in the emulsion favours the more thorough and uniform coating of the cells of the timber to be preserved.

Road Tar Emulsions.

Road tar emulsions can be applied to the road without heating, and when the road is wet. The wetness of the road tends, if anything, to assist the spreading, and helps the emulsion to penetrate into the open spaces of the road metal, and so completely coat the surfaces of the stones or chips. Evaporation and filtration of the emulsion sets in immediately, aided by the pressure action of a roller, and in a short time there remains only the actual binding agent (tar or bitumen, as the case may be), coating the stones with a black sticky surface suitable for holding them together in a continuous aggregate.

"Arcite" contains pitch in an emulsified form. Water in this case is the internal and not the external phase, and so the product has a higher viscosity and has to be heated before applying to the road. On account of its emulsified form, however, it may still be applied to roads which are wet. As you are all aware, pitch is just tar which has been deprived of so much oil that it has become a solid, which, in the cold, has distinctly brittle properties. It is therefore unsuitable alone as a road binding agent, for it will not withstand abrasion. The chief claim of the French patent for the production of this "Arcite" is that the emulsifying agent used does not only contain chemicals which act as emulsifiers, but also contains compounds known as plasticizing agents, which lower the softening point of the pitch so as to render it permanently plastic.

I think that, from a national point of view, the inclusion of such a large quantity of oil in road tars is a colossal waste. Surely the pouring of some 50,000 tons too much oil onto our roads annually is an expensive practice to be going on in days when certain Atlantic liners are using nothing but oil fuel to propel them across the ocean. It may be that the extent of this waste of oil is now generally appreciated in the tar industry. Certainly, the tar distiller of to-day is advocating the use of heavier, thicker, and more viscous tars.

I think it is likely that the most permanent and satisfactory road surface results from the hot application of binding materials of high viscosity. It must be admitted, however, that the application of such heavy materials is troublesome. The viscosity must be reduced by heating, and there is a risk of damage to the binder due to over-heating; there is also the difficulty of spreading in a thin layer a binder which congeals so very rapidly when brought into contact with the cold surface of the road.

If, with the use of small quantities of cheap emulsifying agents, the chemist can spread on the road a product which contains all the sticky binding material necessary for the building of the road, and if in so doing he can save considerably of

the nation's resources in the form of fuel oil, then surely road emulsions will have a future.

The progress of the pioneer of road emulsions may, however, be slow, for in the meantime he is faced by certain formidable facts.

First, at this early period in the history of road emulsions many products are being sent on to the roads which are of very doubtful composition. Secondly, the new material is more expensive per gallon than many other road binding materials. And, lastly, there have still to be overcome those prejudices which most road engineers, surveyors, and county councils seem to cherish for all "new-fangled" preparations.

Discussion.

The CHAIRMAN (Mr. R. D. Keillor), in opening the discussion, said that Mr. Eadie had presented a most original paper.

Mr. SCOBIE (Dunfermline), President of the Eastern District, felt that road surveyors should be asked to dispense with bitumen and use British tar in future. A road tar with a high viscosity could be prepared quite well by the smaller tar works, and would be available for emulsifying if such a procedure was necessary. He thanked the Western Juniors for their kind welcome to the joint meeting.

Mr. EADIE thought that "British Tar for British Roads" should be the slogan of the gas industry, and said that he had raised the question of higher viscosities for road tar because he was of the opinion that such viscous tars gave the best roads, and because the waste of oil in applying thin tars had been brought forcibly to his notice when reading the literature in connection with the French patent "Arcite."

Mr. MELVIN (Uddingston) asked if emulsion repairs required a greater time to set. He also asked what caused the varying colour of tar emulsions.

Mr. EADIE, in reply, explained that a contributory factor causing the pink emulsions of vertical retort tar oils was the presence in these oils of polyhydric phenols. With regard to local repairs with road emulsions, Mr. Eadie did not claim to have any experience on the road, but he sketched out one method he had noted which was used to minimize damage to the repair while the emulsion was setting. A diamond-shaped hole, one diagonal lying in the line of the road, was cut round the pot-hole, and traffic moving over this immediately after the repair did not cause the same disturbance as would be the case with a round hole.

Mr. DUDMAN (Glasgow) spoke of the American method of removing the colouring matter from cresylic acid. A wash with solutions of borax, it was claimed, took out the polyhydric phenols.

Mr. EADIE explained that they had tried out this method in the laboratory in Provan Chemical Works, but with no success. It was possible that the tar distillates at Provan were too much of the nature of low-temperature tar oils to be successfully treated in this way.

Mr. DUNCAN (Perth) and Mr. YUILL (Alloa) expressed their thanks to Mr. Eadie for his paper.

Mr. KEILLOR stated that the Fuel Research Board has at present under consideration the question of emulsification. He also referred to the Lessing method of treating crude tar with solvents in order to recover the more volatile products from the pitch. He asked what thickness of "Arcite" surfacing was prescribed for roads.

Mr. EADIE regretted that he did not have any first-hand information regarding the quantity of "Arcite" used on the road. He was of the opinion that probably three-quarters of a gallon per square yard was used for surfacing, but this figure would, of course, include a considerable proportion of water. When surface "Arcite" was spread, a liberal dressing of chips gave the road the finished appearance of a gravel path, but the amount of traffic improved this condition by embedding the chips gradually into the plastic pitch of the "Arcite."

In conclusion, Mr. KEILLOR thanked Mr. Eadie for his splendid addition to the transactions of the Association, and called for a vote of thanks, which was cordially awarded.

The following is the syllabus of the Scottish Junior Gas Association (Western District) for the remainder of the 1929-30 session.

1929.
Dec. 7.—Question Night.
" 18.—Visit to Messrs. Stewarts & Lloyds' Tube Works (Solid Drawn Tubes).
1930.
Jan. 11.—Joint Meeting with Eastern District at Edinburgh. Address by Mr. H. J. Toogood (Messrs. R. Dempster & Sons), Elland.
" 25.—Paper by Mr. Alex. Tran, Helensburgh, "Some Notes on Ferro-Concrete." Also Mr. A. M'Farlane will read his Thesis which gained the Diploma of the Gas Engineers' Institute.
Feb. 8.—Annual Social. Address by Mr. Harold E. Copp, M.Inst.C.E., Vice-President of the Institution of Gas Engineers.
" 22.—Visit to Greenock Gas-Works.
Mar. 8.—Annual General Meeting. Paper by Mr. John Greig, Glasgow, "Production of High-Grade Coke."
" 22.—Visit to Bussey Coal Distillation Company, Ltd., Glenboig.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Legion Book.

SIR,—May I draw the attention of the readers of your paper to the words spoken by H.R.H. the Prince of Wales at the Remembrance Festival at the Royal Albert Hall on Armistice Night? In the course of his speech, His Royal Highness said: "I would appeal to everyone in the United Kingdom who can afford to do so to make a point of including a copy of this book among their Christmas presents."

Nearly all your readers will be engaged at the present moment in buying Christmas presents, and I feel that if they include a copy of "The Legion Book"* in their Christmas lists they will not only be helping the cause of our ex-service men, but will also be making a present that will be enormously appreciated by the recipient.

JELLICOE,
President, British Legion.

Haig House,
26, Eccleston Square,
London, S.W. 1,
Nov. 28, 1929.

* Published by Cassell & Co., Ltd.; price 21s. (postage 9d. extra).

Edinburgh's Waterless Gasholder.

SIR,—The description of the new waterless gasholder included in your report of the visit of the Scottish Junior Gas Association to Granton makes interesting reading; but I suggest that some of the particulars which are stated in contrast with other types require amplification in order to be correctly understood. I am sure Mr. Gracie desires to assist the rising generation of gas engineers to a sound judgment on this important matter, and there are some points that seem to need further elucidation.

In stating the load on foundations of the waterless holder as 1500 tons, has Mr. Gracie taken into account the wind pressure which is transmitted directly to the foundation, and is a considerable addition to the dead load of the structure? Furthermore, it is quite practicable, where ground conditions are unfavourable, to make the tank for a water-sealed gasholder of annular form, in which case the load on the foundations would be comparable with that of the waterless. Then as to height, there is no constructional difficulty in making spiral gasholders taller than the usually accepted rule of "height approximating to diameter;" but a gasholder of any form 235 ft. high will hardly be welcome to the immediate residents of any district. Also there are, in these days, aircraft risks to such tall structures that cannot be prudently ignored.

Another point Mr. Gracie mentioned was that the height could at any future time be raised so as to increase the capacity; but if such extension is contemplated, provision must be made in the original design for the increased wind pressure that the stanchions, holding-down bolts, and foundations will in the future have to withstand. It is very startling to hear that Mr. Gracie finds a saving of about £20,000 by the adoption of the waterless type compared with the spiral holder, as this does not appear to be confirmed by recent published information of a very definite nature; also it is difficult to understand how the foundations of a waterless holder can cost less than for either a spiral or column guided holder when the anchorage for wind pressure on this very tall structure is duly taken into account.

Although the waterless holder is not intermittently in and out of water like the ordinary type, it is fully exposed to the atmosphere, and thus constantly wetted by rain and moisture condensing out of the air; so it seems very doubtful whether there will be any advantage in wear and tear over an ordinary gasholder. There are many instances where the external guide framings of gasholders have shown signs of corrosion at a much earlier date than the floating gasholder; and as the sheets of the waterless structure have to be bent in manufacture at right angles and beyond the elastic limit of the metal, it is very possible that corrosion will occur at these points more readily than in the case of the plain flat sheets of an ordinary water-sealed holder.

The simplicity of the painting also seems a debatable point when the character of the external surfaces, the height of the structure, and the disc and roof conditions are taken into account—especially as in a water-sealed holder most of the painting can be done from ground level as the bells rise from the tank. I notice that Mr. Gracie, in his concluding remarks, mentions that it is intended to "select colours which would make the structure as inconspicuous as possible, and give it the effect of melting into the landscape," which hardly seems consistent with his previous remark about "improving the beauty of the landscape."

"NEW AGE."

Nov. 30, 1929.

REGISTER OF PATENTS.

Coke Extractor Mechanism for Vertical Retorts. Nos. 320,232 and 320,233.

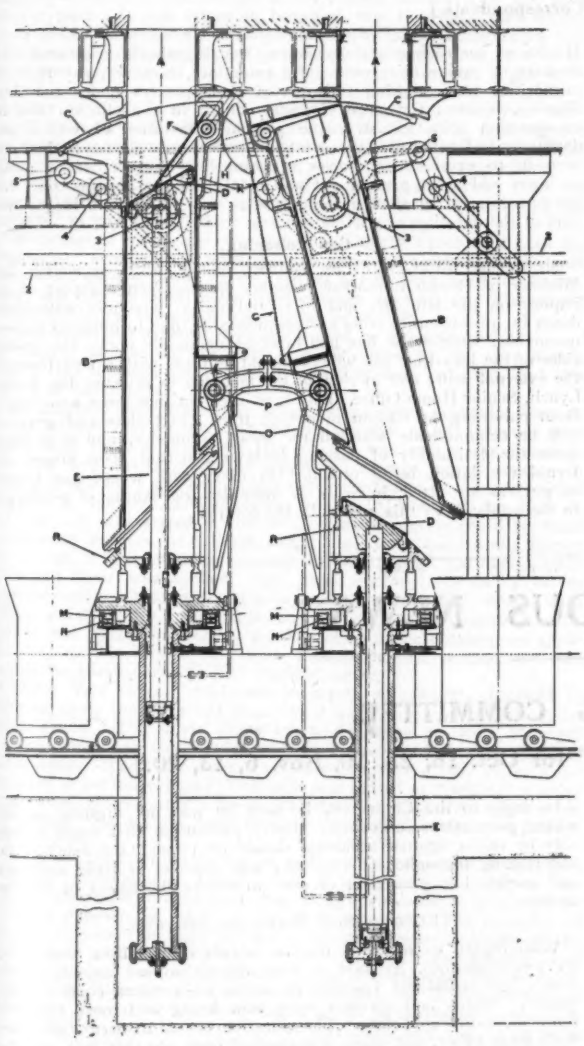
WEST, E., and WEST'S GAS IMPROVEMENT COMPANY, LTD., all of Miles Platting.

Nos. 29,313 and 29,315; Oct. 11, 1928.

These inventions relate to the coke extractor mechanism of vertical retorts of the type in which a coke chamber beneath the retort is swung about its pivotal support to discharge its contents.

The objects of the inventions are to ensure a gas-tight joint between the top of the coke chamber and the bottom of the retort to which it is connected, to minimize the friction between the adjacent faces of the joint as the coke chamber is swung into and out of its normal service position, and to provide simple and efficient means for allowing the independent operation of each coke chamber in a battery of retorts from a single prime mover while ensuring that each such chamber is automatically locked when in its normal service position and disconnected from the prime mover.

The illustration shows a side sectional elevation of extractor gear for two retorts which operates as follows: When the coke chamber



" B " is swung to its open position, the extension " C " at the top acts as a stopper to support the coal in the retort, but before the chamber is returned to its service or closed position, and before the head " D " of the ram " E " can be raised in the chamber the hinged plate or door " F " is turned by means of the chain " G " (connected to the balance weight " H " upon the pivot of the door plate " F ") to a position across the top of the coke chamber as shown at the right-hand side of the illustration, so that when the coke chamber is closed or in line with the retort, the charge in the latter is carried by the door.

The head " D " of the ram " E " is then raised until it comes beneath the door " F," when the chain " G " holding the door is released.

As the head " D " descends to allow the charge in the retort to descend to the coke chamber, the door " F " also descends as it now rests on the head " D," and finally the door " F " rests in a vertical position in the recess " K " in the side of the coke chamber, where it offers no obstruction to the free descent of the coke.

To regulate the adjustment of the top radial joint, the coke chamber base " R " is mounted upon wedges " M," which are propelled horizontally along the length of the base by means of worm gears operated by hand, the wedges " M " being carried on rollers " N " to minimize friction.

The joint between the pivot bearings " O " is arranged so that each coke chamber may move in a vertical direction without influencing the other coke chamber in each pair.

In order to reduce the friction between the radial contacting faces of the coke chamber and of the base " A " of the retort when the coke chamber is swung relatively to the base " A," the centre of the arc making the top of the coke chamber is set slightly eccentric to, and behind, the pivoting centre " P " of the chamber, so that with the opening of the chamber the top face of the chamber is lowered relative to the retort base " A," leaving a small clearance between the radial faces.

The swinging of the coke chamber is effected from a common reciprocating rod 2 by links and levers which are self-locking when the coke chambers are closed and the reciprocating rod disconnected, because the trunnion centre 3, the shaft centre 4, and the crank centre 5 are in the same straight line.

Gasholders.—No. 316,544.

M.A.N. A.G., of Nuremberg.

No. 12,565; April 23, 1929. Convention date, July 30, 1928.

For telescopic gasholders having sliding seals between the separate sections of the shell, this invention indicates a method of constructing the shell sections, which overcomes rivet head difficulties and at the same time provides a good solution for the question of the guiding of the shell sections with respect to one another, which renders the use of separate guiding frames superfluous. According to this method the individual annular sections of the holder are made of plates each of the height of such a section. Thus there will only be riveted seams extending from the top to the bottom—that is to say, in the raising and lowering direction. Furthermore, to enable countersunk rivets to be used, even where the plates are very thin, post-like reinforcing irons are provided on either side of the riveting seams, which serve the purpose both of receiving the countersunk rivet heads and of providing a stiffening means for the shell sections and of acting as guides for the latter during raising and lowering. As these members have a smooth surface and extend exactly in the direction of motion of the shell sections, they may pass through the seal without interfering in any way with its action. Suitable recesses are provided in the sealing rings, in which the reinforcing members, and consequently the shell sections themselves, are guided.

Low-Temperature Retort.—No. 320,780.

FRASER, W., of Stevenston, and DAVIDSON, W., of Glasgow.

No. 31,588; Oct. 31, 1928.

The patentees claim a retort for low-temperature carbonization provided with a movable plug or bottom on which the charge rests, and so constructed and manipulated that while the charge is being carbonized it is capable of being lowered, and this, in conjunction with the tapered construction of the interior of the retort, provides additional space to accommodate the swelling that takes place during the process.

The movable plug is so constructed as to contain a water seal to prevent air from entering the retort while the process is proceeding.

C.W.G. Manufacture.—No. 320,852.

HUMPHREYS & GLASGOW, LTD., and CARROLL, L. D., both of Victoria Street, S.W. 1.

No. 18,119; June 22, 1928.

Essentially the present invention consists in dividing the gas as it leaves the generator into two streams, one of which enters the holder without passing through the carburettor, while the other is first passed through the carburettor and enriched with oil. The gas to be thus divided may be that produced during an up run, during a down run, or during a portion of either or both runs as may be found convenient.

When the invention is being carried out in connection with water gas produced by steaming fuel in a direction the reverse of that in which it has been blasted with air (ordinarily the down run), the usual disadvantage of cooling the carburettor top by the relatively cool down-run gas is avoided or minimized, owing to the reduction in quantity of the down-run gas passing through the carburettor. Use is more efficiently made of the carburettor in accordance with the invention in that it is idle for a smaller proportion of the total gas making time than when oil enrichment occurs intermittently during certain runs or during parts of the run, while the advantage of being able to recover some of the sensible heat of unenriched gas is maintained where this is deemed desirable.

Although the gases passing to the holder may not be of absolutely constant quality, they will be more nearly so than when carburetted and uncarburetted gases are made alternately. Again, in the case of a set with waste-heat boiler, by employing the invention during

both up and down runs—*i.e.*, conducting a part of both up and down run gas past the carburettor to the boiler—uniform flow through such boiler can be more nearly approached, resulting in a more satisfactory working.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 20.]

Nos. 34,299—35,121.

BLACK, D. B.—"Gas cocks." No. 34,629.
BLAKE, J. P.—See Black, D. B. No. 34,629.
BULL, E. V.—"Gas fire." No. 34,576.
BUTTERWORTH, E.—"Gas meters." No. 34,621.
EVANS, E.—"Gas cooking and heating appliance." No. 34,931.
I. G. FARBENINDUSTRIE AKT.-GES.—"Apparatus for low-temperature carbonization." No. 34,366.
JOHNSON, J. Y.—See I. G. Farbenindustrie Akt.-Ges. No. 34,366.
MAIN, R. & A., LTD.—"Injectors for gas burners." No. 34,667.
MANGIAMELI, F.—"Apparatus for protecting gas mains from back fire." No. 34,379.
PARKINSON & COWAN (GAS METERS), LTD.—See Butterworth, E. No. 34,621.
SAUNDERS, A. P.—See Main, R. & A., Ltd. No. 34,667.
SEMET-SOLVAY ENGINEERING CORPORATION.—"Recovery of waste heat in water gas operations." No. 34,714.
STETTINER CHAMOTTE FABRIK AKT.-GES. VORM. DIDIER.—"Heating ovens by gas." No. 34,647.
THORP, F.—See Butterworth, E. No. 34,621.
WORTLEY, G. W.—See Main, R. & A., Ltd. No. 34,667.

[Extracted from the "Official Journal" for Nov. 27.]

Nos. 35,122—35,973.

CLAYTON, R. F.—"Gas producers." No. 35,197.
GRANT, H. M.—"Doors for coke ovens." No. 35,625.
HUMPHREYS & GLASGOW, LTD.—"Gas generators." No. 35,330.
PEARSON, A. R.—"Intermittently operating gas burners. No. 35,810.
PRESTAGE, E.—"High-pressure gas compressors." No. 35,664.
SMITH, D. J.—See Clayton, R. F. No. 35,197.
SOUTH METROPOLITAN GAS COMPANY.—See Pearson, A. R. No. 35,810.

PARLIAMENTARY INTELLIGENCE.

[From Our Special Correspondents.]

HOUSE OF COMMONS.

Road Construction (British Tar).

Mr. HANNON asked the Minister of Transport whether his Department had adopted or approved any general scheme relating to road construction which would encourage the fullest use of British tar, seeing that an increased output of British tar would be helpful to the coke-oven and steel industries, and consequently to the coal industry.

Mr. HERBERT MORRISON replied that he was encouraging the initiation by local authorities of extensive schemes of road construction and improvement, the result of which would be to promote the demand for road materials of all kinds, including British tar.

Smoke Abatement.

Commander BELLAIRS asked the Minister of Health whether he had been able to form any estimate as to the working of the Smoke Abatement Act, 1926; whether he was satisfied that all local authorities were endeavouring to apply the powers they possessed under the Bill; in how many cases the Ministry had had to exercise its powers to compel the local authorities to make by-laws regulating the smoke nuisance; and whether he would consider the appointment of an independent committee to bring pressure on local authorities and co-ordinate the work all over the country.

Mr. GREENWOOD replied there was evidence in the Ministry of Health of increasing activity among local authorities generally in matters of smoke abatement. He could not, however, say that all authorities were making full use of their powers under the Act. There was room for more vigorous action, in consultation and in co-operation with industry, the present difficulties of which undoubtedly had acted as a deterrent in some areas. So far he had not seen fit to exercise the power of compelling authorities to make by-laws, and as at present advised he did not see any necessity for the appointment of such a committee as was referred to in the last part of the question.

Gas Poisoning.

Sir ALFRED BUTT, M.P. for Balham and Tooting, is asking the Minister of Health to-morrow whether he has seen a report of an inquest on the late Mr. and Mrs. Bottomley, who met with their death by misadventure from carbon monoxide, due to inhaling carbon monoxide; whether he has had brought under his notice the strong rider of the jury that gas boilers should be fitted with a vent through the external wall; and in view of the fact that in evidence Dr. Roche Lynch, Senior Home Office Analyst, pointed out that there was danger from poisoning by carbon monoxide from gas boilers and geysers, will he communicate with all the local authorities, and urge upon them the desirability of passing by-laws insisting upon proper external ventilation being provided in every case where gas boilers or geysers are fitted, in order to minimize the danger of poisoning to the public from this source in the future?

MISCELLANEOUS NEWS.

GAS POISONING COMMITTEE.

[For Earlier Evidence see "JOURNAL" for Oct. 16, 23, 30, Nov. 6, 13, 20.]

The Committee appointed by the Government to inquire into the danger of accidents by coal gas poisoning held a further meeting, at the Board of Trade Offices, Westminster, S.W. 1, on Tuesday, Nov. 26, when evidence was given by Mr. Arthur Valon (of Messrs. W. A. Valon & Sons, Civil Engineers, of Westminster). Mr. Valon is a member of the Institution of Civil Engineers, the Institution of Gas Engineers, and the Association of Consulting Engineers, and a Past-President of the Society of Engineers. He is Consultant to a number of gas undertakings throughout the country.

Questioned by the Chairman of the Committee, he said that no one who had read the published reports of inquests could have any doubt that a considerable proportion of the deaths attributed to accidents were in reality suicides. This was indicated by analysis of the accidents reported to the Board of Trade as due to gas poisoning from the year 1922. In the categories where the presumption was that the cause was accidental, the figures fluctuated from year to year; whereas in those categories where the causes might be either accident or suicide, the accident figures had risen, as had the suicide figures. The total number of cases of gas poisoning in each year in those categories where the presumption was that the cause was accidental (and omitting those categories in which poisoning might have been suicidal), were: 1922, 42; 1923, 29; 1924, 20; 1925, 42; 1926, 35; 1927, 57; and 1928, 37. These figures indicated no steady increase of accidents; in fact, the number in 1928 was lower than in 1922. Further, the number of accidents did not vary with the percentage of water gas supplied in the town gas. For instance, in 1926, which was the year of the coal strike, the percentage of water gas supplied was increased, but the number of accidents was lower than in most years.

In reply to the Chairman, he said he was not arguing against taking precautions, of course. Every precaution that could reasonably be taken against accidents should be taken; the average gas undertaking throughout the country was anxious to avoid accidents, and exercised a great deal of care to ensure the safety of its consumers.

ESCAPES FROM MAINS AND SERVICES.

With regard to accidents due to escapes of gas from mains and services (external), he said it was difficult to see any means by which the occasional fracture of mains or services could be prevented. Mains and services were now being laid more carefully, however, than ever before. The vibration due to modern traffic must have some effect, but where a main had been properly laid, and had a good concrete road over it, he did not think the vibration was very serious. The modern concrete road probably protected the mains beneath, but, at the same time, it made more difficult the detection of a leak, and repairs were more expensive. He doubted that the total cost of maintenance of mains over a number of years had been increased, because, though under modern conditions they were more expensive to repair, he believed that in the long run there would be less to repair.

Questions were asked by the Chairman as to whether it would be desirable generally to provide gratings or manholes in the streets which would serve as outlets for any gas escaping from a main under the concrete foundations of the road, and to render the detection of leakages easier. Mr. Valon was of opinion that the gratings or manholes would not be very effective, unless one was provided at almost every joint of the main—and the joints occurred at intervals of 9 or 12 ft. He had read the evidence given by Mr. E. J. Silcock

(see "JOURNAL" for Oct. 23, p. 254), in which the provision of gratings at intervals of 50 or 100 yards had been suggested. Even under present conditions, however, one could nearly always detect a leak within 50 or 100 yards.

Prof. R. V. WHEELER (a member of the Committee) pointed out that it had apparently taken a very long time in Victoria Street, where the road was still up.

Witness replied that he did not think the distance was more than 100 yards. It was not always easy to detect a leak, but as a general rule any escape of gas was detected by smell, and was reported.

Discussing accidents resulting from the penetration of gas from a fractured main into houses abutting on the roads, he said they were not very frequent, but they might possibly have been prevented if there had been no openings in the house walls below the surface level of the street. There were many openings made, however, for the passage of gas and water pipes, electricity cables, &c.; and it was not of much use stopping-up one opening unless the whole of the openings were stopped-up. Whenever a hole is made in a wall to allow the passage of a pipe, it should be properly sealed up.

INTERNAL LEAKAGES.

The dangers of internal leakages were then discussed, and Mr. Valon drew attention to the increasing tendency among gas undertakings to make arrangements for inspecting the pipes and fittings in new houses when first installed, and for inspecting the fittings and apparatus in the houses from time to time, usually with some form of maintenance. Periodical inspection was the best safeguard against accidents; and, though it was a little expensive, he was sure that it paid. It was essential, however, that this inspection should be a matter of voluntary arrangement between the undertaking and the consumer, because in his experience nothing led to more friction than any form of compulsory inspection. Further, if gas companies were bound to inspect, that fact might be held to place a liability on them in cases of accident. Companies which had instituted systems had not experienced any difficulty in making the necessary arrangements for inspection, and he could not recollect any case in which a consumer had refused to allow inspection.

Prepayment meter consumers had an opportunity, every time the money in their meters was collected, of drawing the attention of the collector to any fitting which was not satisfactory.

With regard to the use of various appliances which had been invented for avoiding the turning-on of gas taps accidentally, he said they were used to some extent, but as a rule they were too expensive, and they involved extra trouble when turning on. The people would not go to the additional expense or trouble.

The CHAIRMAN asked if they really need be more expensive.

Witness said he did not know that they need be, but they mostly were. He supposed that in most cases they were patented, and this added to the expense.

In England and Wales, he added, there were probably from 25 to 30 million taps in use, and the replacement of any effective proportion of these with a new type of tap was out of the question. He had seen one new type of tap which seemed very practical. A safety device for a gas burner had been referred to in a letter written by Mr. S. Howard, and published in the "JOURNAL" for Nov. 6, p. 396. (It was stated in the letter that the device could be fitted to existing burners, and, if the supply cock were accidentally turned or left on, it prevented any passage of gas through the burner until a naked flame was applied. The flame actuated the safety device automatically, allowing the gas to pass through. The device, with slight modifications, could also be applied to gas cookers.) The writer had stated that further particulars could be obtained on application, but Mr. Valon said that, though he had written and had asked for particulars, he had received no reply.

There were several objections to meter adjustments designed to prevent more than a small quantity of gas being passed during the night hours. The safety meter invented by the Assistant Manager of the Municipal Gas-Works at The Hague had a valve worked by a lever. When this lever was placed at "day," the meter could be used to its full capacity; when it was placed at "night," a valve was closed so that only a small pre-determined quantity of gas could be passed. He did not think it could very well be fitted to a prepayment meter.

The first objection to the use of such a meter was that it increased expense. Secondly, it would result in inconvenience. One of the great advantages of gas was that it was available at any time or for any purpose for which it might be required. The quantity of gas to be passed at night by the safety meter was arranged on the assumption that gas would be required normally for lighting, and then only to a very small extent. Gas heating was used more in this country than on the Continent, however, and if it were desired to light a gas fire or a boiling ring it would be necessary to go down to the cellar, or wherever the meter was fixed, and turn it on from "night" to "day." An Englishman might do that once, but he would not do it again; it would probably not suit English consumers. It was clear that, if the meter had to be arranged so as to pass sufficient gas for a stove, the safety device would be completely ineffective.

There was also an attachment to the safety meter so that, if the supply of gas ran out during the night, the full supply could not be obtained until any tap which had been left open had been turned off. The trouble with these "gadgets" was that, though they might work well when new, probably something would go wrong when they were required to work. It seemed to him that the safety valve arrangement would interfere with the free flow of gas—*i.e.*, would reduce the capacity of the service—and might lead to frequent trouble by defective action.

In addition to these objections, he said it was his opinion that it would be useless to rely on any device which required the consumer to do something to it. He was convinced that, if these meters were installed, the lever would be left in the same position and never altered. It must be remembered that there were over 8 million consumers in England and Wales, the vast majority of whom had neither had an accident nor come into contact with one.

The CHAIRMAN commented that this seemed to be an argument in support of leaving things as they were.

Witness replied that he was not arguing against progress, but had mentioned the matter in order to emphasize the difficulty of getting consumers to employ any safety appliance when the use of it gave them any trouble. If there were a reasonable, simple, and cheap safety appliance, there was no reason why consumers should not be expected to use it; but if it meant changing all the meters now installed, the expense would be great.

LIMITATION OF CARBON MONOXIDE.

The desirability or otherwise of limiting the proportion of carbon monoxide in gas was next discussed, and Mr. Valon expressed the opinion that limitation would be undesirable. The question had been discussed fully in 1921, and the position had not altered since. The economic objections to limitation were still as strong as ever they were. If it were not for the manufacture of water gas, there would be a very large surplus of coke over the demand, and the effect upon the coke market would be disastrous. Probably it would be impossible, even at the lower coke prices which would then prevail, to sell more than a small proportion of the extra coke made available. The loss from this cause, together with the cost of substituting coal gas plant for the existing water gas plant, made the abolition of water gas economically impossible. If a limitation were made which left the industry practically in the position it was in at the moment, it could not have any effect on the accident rate; while it would hamper the search for new methods of providing heat units at a lower cost. Carbon monoxide was a very valuable fuel, as it burned with a hot short flame. Its radiating power was 2½ times that of a hydrogen flame of equal size. This property was very valuable in furnace work or for heating processes, and in domestic fires. Water gas was of great value as a stand-by in emergency. Plant could be brought isto operation very quickly, as compared with coal gas plant, and it involved only about one-third the capital outlay. Had it not been for the existence of water gas plants during the coal stoppage in 1926, it would have been impossible to have maintained the supply of gas.

He had been reading the experiments made by Dr. Haldane in 1898 with Bray flat-flame burners, which were supposed to pass 4, 5, 6, and 7 c.ft. per hour respectively; the purpose of the experiments being to find out under what conditions a toxic atmosphere was produced in a room of a certain size. Dr. Haldane had pointed out that the burners had passed a good deal more gas, under the conditions in which he was testing, than the quantities they were supposed to have passed, and that if one used a governed 4 c.ft. per hour burner which would pass only 4 c.ft. per hour, one could supply a gas containing 25 p.ct. of carbon monoxide and obtain the same results as would be obtained with a gas containing 10 p.ct. of carbon monoxide if supplied through burners used as he had employed them. Mr. Valon pointed out that the burner used to-day did not pass even as much as 4 c.ft. per hour, so that a gas containing 25 p.ct. of carbon monoxide to-day was not likely to cause more accidents than a gas containing 10 p.ct. under the conditions applying to Dr. Haldane's experiments.

Prof. WHEELER asked how Mr. Valon's remarks applied to boiling rings.

Witness said they did not apply. There were boiling rings in bedrooms, but the chief danger of accident, he believed, was in respect of lighting burners. He considered, however, that it would be safe not to impose any limitation. He would not say that a gas which was more toxic was not less safe than a gas which was less toxic, to a point. A non-poisonous gas, of course, could not cause fatal accidents, and, as its poisoning properties were increased, a point would be reached at which it could cause fatalities. It did not matter how much more poisonous it was after that.

Replying to the Chairman, he said he knew of no gas which contained no poisonous constituents and which could be substituted for coal gas for heating.

Prof. WHEELER asked questions with regard to the education of fitters in the gas industry, and said he believed the Institution of Gas Engineers had a scheme for the education of these men.

Witness agreed that that was resulting in improvement, and added that the big gas undertakings looked after the education of their own fitters also.

Further questions were asked by Prof. Wheeler as to whether gas companies were experiencing difficulties through the sale to the public of inferior fittings. Mr. Valon replied that they had at one time, but not at present; he believed the gas companies had now almost a monopoly.

Prof. WHEELER said that, if there were to be no limitation of the carbon monoxide content of gas, it was clear that the only line of defence was to ensure that the fittings were good.

Witness suggested, if the fittings were all right, it did not really matter what proportion of carbon monoxide was contained in the gas.

Questioned as to the use of steel for mains, witness expressed the view that, in suitable circumstances, steel was a very useful material for mains, but it had drawbacks. It was more difficult, for instance, to make a joint of a service pipe to a steel main than to a cast-iron main; special arrangements had to be made. He did not think that, as a rule, the joints leaked more, but there was more likelihood of leakage than from a cast-iron main.

Prof. WHEELER asked at what stage, in the addition of carbon monoxide to town gas, the gas would become so poisonous that it did not matter how much more poisonous it was made.

Witness suggested from 15 to 18 p.ct.

Prof. WHEELER said that meant, presumably, that, in order to ensure that the gas would not be dangerous, there should be a limit of 18 p.ct.

Witness disagreed, and said that if the gas contained 18 p.ct. of carbon monoxide there was no point in limiting it to that figure.

Depth of Cover for Mains.

Replying to questions by Sir John Robertson (a member of the Committee), as to the depth at which gas mains should be laid, Mr. Valon suggested that the top of a main ought to be at distance of from 20 in. to 2 ft. below the concrete foundations of the road in order to avoid damage due to severe frost. This would also provide a sufficient cushion of earth above the main to prevent damage arising from traffic, if the foundation on which the main was laid was reasonably solid.

Sir John Robertson asked whether, if all holes made in the walls of houses below the road surface for the purpose of carrying service pipes were sealed, there would still be a possibility of gas, which might escape from a main in the road, getting under the footings of a house or through the brickwork.

Witness said he supposed it was possible, but he had never known a case in which gas had passed through a brick wall, though he admitted there had been instances in which it had been difficult to discover how gas had entered houses. From an engineering point of view, he saw no difficulty in requiring that, when holes were made in walls for the passage of pipes, they should be sealed up afterwards. The difficulty would be to deal with existing houses where that practice had not been adopted.

With regard to inspection, Sir John agreed that a voluntary scheme of inspection would probably be more effective than compulsory inspection, and he asked how often it should be made. Mr. Valon considered that it would be sufficient to inspect annually.

Sir John Robertson asked if inspection would consist of a pressure test of the fittings and examination of the pipes, because he had seen old iron gas pipes rusted up, and they were very defective.

Witness said he had in mind the inspection of everything within sight. A leakage from a pipe in the ordinary way would be detected at once by smell. As to pressure testing, he remarked that it was usual to turn all gas taps off, and watch the meter to see if were passing gas; and he considered this a good and effective test. He was of opinion that, if taps were inspected once a year, they would not become loose in the interim, providing, of course, that they were good taps. The cost of inspection might amount to the equivalent of 1d. or 1½d. per 1000 c.ft.

Mr. F. J. Wrottesley, K.C. (a member of the Committee), was concerned with regard to the carbon monoxide content, and referred to figures concerning Metropolitan areas of more or less similar nature, which showed that, in the area where the gas contained the least carbon monoxide, the death rate was lowest, and in the area in which the gas contained most carbon monoxide the death rate was highest, while the death rates in the other areas corresponded with the variation of the ratio of carbon monoxide.

Witness said that the death rates did not vary in proportion to the percentage of carbon monoxide in the gas. In two areas, for instance, having practically the same accident rate, there was a considerable difference in the proportions of carbon monoxide in the gas supplied.

Mr. Wrottesley said that the figures relating to undertakings supplying over 100 million c.ft. showed that the average death rate per thousand consumers in areas in which the gas contained 12 p.ct. or more of carbon monoxide was 0·15, whereas the rate in the case of areas supplied with gas containing less than 12 p.ct. was 0·08—or about half.

Witness pointed out that the undertakings supplying gas containing less than 12 p.ct. of carbon monoxide included those supplying a straight coal gas only. He did not deny that straight coal gas was less likely to be fatal than a gas containing a considerable proportion of carbon monoxide; but if one compared the figures relating to undertakings supplying gas containing 15 p.ct. of water gas and those supplying gas containing 30 p.ct. the results would not be the same as suggested.

Further questions were put with regard to the percentage of water gas supplied, and the advisability of giving power to some Government authority to prevent its use if it led to an increased death rate. Mr. Valon replied that, if it were clear that a high percentage of water gas in town gas did result in a large increase in the death rate, no doubt it would be stopped.

Mr. Wrottesley suggested that it was important that somebody should keep an eye on this matter. The gas industry, for instance, might become lethargic.

Witness did not think there was any possibility of the gas industry becoming lethargic.

The Committee adjourned till to-morrow.

BOLTON GAS SPECIAL ORDER.

Application for Increased Maximum Price.

An inquiry which proved to be of an unusual nature was conducted on Tuesday, Nov. 19, at the Board of Trade Offices, Westminster, by Mr. J. F. Ronca (Director of Gas Administration). It concerned a Special Order promoted by the Bolton Corporation under section 10 of the Gas Regulation Act, the sole purpose of which was to increase the maximum charge for gas supplied by the Bolton Corporation to 5s. 4d. per 1000 c.ft. The present maximum price is 4s. per 1000 c.ft., and this maximum has applied for many years, except for a short period immediately after the war, when it was increased under the powers of the Statutory Undertakings (Temporary Increase of Charges) Act. The Corporation have not applied for an Order under section 1. of the Gas Regulation Act of 1920 to authorize an increased maximum price.

The only opposition to the Order came from the Horwich Urban District Council, whose area is supplied with gas by the Bolton Corporation. They asked that the maximum price should not be increased, and that a clause should be inserted in the Order prohibiting the Corporation from applying profits on the gas undertaking to the relief of rates in the Borough.

The Corporation were represented by Mr. Jacques Abady, and the Horwich Urban District Council by Mr. Rowand Harker, K.C.

Mr. Abady, opening the case for the Corporation, traced its legislative history. In the course of his statement, he said that prior to 1925 the Corporation had had power to charge a higher price in Horwich than in Bolton, but by an Act passed in that year, the right to charge the higher price in Horwich was swept away, though at the same time the Corporation's freedom to manage its undertaking in its own way was preserved. The present opposition by the Horwich Urban District Council, he suggested, was an attempt to deprive the Corporation of that freedom. With regard to price and calorific value, he said that, by an Order made in 1917, the standard calorific value was fixed at 500 B.Th.U. per c.ft., the maximum price of 4s. per 1000 c.ft., which had applied for many years, being retained. In fact, however, the Corporation were not supplying gas of that value. The calorific value of the gas supplied was 450 B.Th.U. per c.ft.; the reasons being that it was more advantageous both from the point of view of cost of manufacture and from the point of view of the convenience to the consumers. Gas was charged for on a scale depending upon the quantities used, the maximum price being charged to consumers using amounts up to 1000 c.ft. per quarter. Strictly speaking, said Counsel, in so far as they were charging some consumers the maximum price of 4s. per 1000 c.ft. for gas of 450 B.Th.U., there had been an infringement of the provisions of the Corporation's Acts and Orders.

Mr. Harker: Or an illegal overcharge.

Mr. Abady, continuing, said that inasmuch as the bulk of the gas supplied had been charged for at prices below the maximum, however, it could fairly be argued that the consumers had benefited by reason of the fact that they had been supplied with gas of a quality more advantageous to them than gas of 500 B.Th.U. per c.ft. The Corporation had not applied for an Order under section 1. of the Gas Regulation Act to authorize an increase in the maximum price, though costs had increased considerably since the pre-war period. The average net cost of gas manufacture for the six pre-war years was 17·67d. per 1000 c.ft., and the average capital charges amounted to 6·44d., making a total of about 24d. The net cost of gas for the year 1928-29 was 27·8d., and the capital charges 8·06d.—a total of 35·86d. It would appear from those figures that, on the general principles which had guided the Board of Trade in authorizing increases under section 1. of the Gas Regulation Act, the Corporation would have been entitled to an increase of maximum price to the extent of about 1s. It had been the rule of the Department, when an application was made under section 1., not to inquire into the appropriateness of the then existing maximum price, but to add to that existing maximum price an amount equivalent to the increased costs incurred as the result of circumstances beyond the control of the applicant gas undertakings.

For the first nine months of the year ended March, 1923, the Corporation had made a uniform charge for gas, the charge being 4s. 8d. per 1000 c.ft., and for the last quarter of that year the price had been 4s. 4d., this being the period when the Temporary Increase of Charges Order was in operation. In 1923, however, in view of the necessity of selling gas to manufacturers at low prices in order to compete with electricity and other sources of power, the Corporation had instituted a scale of charges ranging from 4s. down to 2s. 2d. per 1000 c.ft., depending upon the quantities used, the maximum price of 4s. being charged to those using up to 1000 c.ft. per quarter. Those prices, however, were subject to discounts of 2d. per 1000 c.ft. if payment were made within 21 days. About 25 p.ct. of the gas sold in the last financial year—293 million c.ft.—had been sold to large consumers. The revenue from gas during the last financial year amounted to 35·92d. per 1000 c.ft., and the cost of gas, including capital charges, income-tax, and revenue contribution, was 37·84d. per 1000 c.ft., and there had been a deficiency of about £10,000 on the year's working. Gas had been sold to private consumers, for domestic and industrial purposes, at the respective average prices of 3s. 1d. and 2s. 6d., and further quantities had been sold for public lighting at 2s. 8d. The total revenue was £184,610. If all the different prices charged were divided by five in order to arrive at the prices per therm (because the Order of 1917 had provided for the supply of a 500 B.Th.U. gas), and if those prices per therm were charged, the revenue would be less, in view of the fact that the gas actually supplied was a 450 B.Th.U. gas; the revenue would be reduced to £166,000, so that there would be a further loss of £18,000. The Corporation wished to continue the scale of charges to which consumers had been accustomed since 1923, and to translate the charges from prices per 1000 c.ft. to prices per therm, but the divisor they wished to use, assuming that costs remained the same, was 4·5 instead of 5. That would mean exceeding the present maximum price; they wanted the maximum price per thousand adjusted so that, when divided by five, the result would be equal to the result obtained by dividing the present maximum price of 4s. by 4·5. That

would necessitate an increase of maximum price of 5·3d., or (say) 6d. per 1000 c.ft.

Again, 1d. per 1000 c.ft. represented a revenue of £5000 per annum, and, as they had incurred a deficiency of £10,000 in the year 1928-29, they considered that was a reason why another 2d. per 1000 c.ft. should be added to the maximum price. Another reason for asking for an increase was the anticipation that the price of coal would increase. The present price was 21s. per ton, but the average price for the past ten years was 28s. 4d. per ton. It was asked that the maximum price should be increased another 5d. in view of the possibility of an increase in the price of coal. The cost of manufacturing gas before the war was 2s. per 1000 c.ft., and the maximum price was 4s., so that there was a margin of 2s. between the cost of manufacture and maximum price. The maximum price per therm to-day, obtained by dividing the 4s. by 5, was 9·6d. The cost of manufacture was 37·8d. per 1000 c.ft. for a 450 B.Th.U. gas, so that the cost per therm was 8·4d. Thus the margin between cost of manufacture and maximum price was 1·2d. The Corporation were actually charging more than 9·6d. per therm to some consumers, so that if the maximum price were not raised they would have to reduce the present price to those consumers, notwithstanding that the undertaking was suffering a loss. If the pre-war margin of 2s. per 1000 c.ft. between the cost of manufacture and the maximum price were reasonable, then a margin of 1·2d. per therm could not be reasonable to-day. The scale of charges, by which larger consumers of gas were charged lower prices, had been worked out very carefully, and had enabled the Corporation to keep up the consumption of gas in the area of supply.

It appeared that the Horwich Urban District Council wished to dictate to the Corporation as to the management of the undertaking without bearing any of the responsibility. If the Urban District Council liked to talk to the Corporation about taking any of the responsibility for losses incurred, they might with more reason urge that the undertaking should to some extent be subject to control at their behest.

Mr. HARKER asked if, in making that suggestion, Mr. Abady had in mind any idea that some of the £672,000 that had been transferred from the undertaking in the past for the relief of rates should be returned.

Mr. ABADY said he had not. As a matter of fact, nothing had been transferred from the undertaking to the relief of rates for ten years, and it was not the intention of the Corporation to take further sums for the relief of rates. That was quite different from saying, however, that they should be bound, as in a strait-jacket. His statement might invite the suggestion that, if there were no intention of transferring money to relief of rates, there should be no objection to a clause to prevent it, but there was a great difference between having a right and not wishing to exercise it, and being deprived of that right.

Mr. *W. J. Smith* (Gas Engineer to the Bolton Corporation) then gave evidence.

Mr. HARKER, cross-examining, asked if the real reason for the promotion of this Special Order was the passing of the Gas Undertakings Act of 1929.

Mr. *Smith* replied that the real reason was the extremely low maximum charge permissible in Bolton as compared with other towns.

Mr. HARKER asked why the Corporation had not made an application under section I. of the Gas Regulation Act, because, by doing so, they might have been able to secure a substantial increase in the maximum price.

Mr. *Smith* said he understood that if gas undertakers did not apply for Orders under section I., the Board of Trade would, in due course, rope them in, and the Bolton Corporation had been content to wait until the Board did that. Until last year, the 4s. maximum would have been sufficient, on a calorific value of 450 B.Th.U.

Mr. HARKER pointed out that considerable economies had been achieved in 1927, 1928, and 1929.

Mr. *Smith* agreed; but he feared that the price of coal would go up.

Mr. HARKER commented that all applicants for Orders such as this feared that the price of coal would go up. He asked if Mr. Smith did not hope to maintain economies in working, and even to attain better results when the contemplated new works were complete.

Mr. *Smith* said he always hoped to obtain better results, but did not see much prospect of costs decreasing, because of the anticipated rise in the price of coal.

In reply to questions as to costs of distribution, Mr. Smith said he anticipated increased costs. There were new housing schemes, and the supply to them would involve new meters, services, &c. There were small consumers in all gas undertakings to whom the supply of gas was not a paying proposition at the prices which had to be charged.

Mr. HARKER, cross-examining in regard to the losses incurred by the undertaking, pointed out that 1929 was the first year since 1923 in which a loss had been incurred. The loss in 1929 was said to be £10,000, but the accounts showed that £6400 was spent from revenue, but should have been debited to capital account. Therefore, the actual loss was £3600. Further questions concerned the policy of the Corporation with regard to the transfer of profits on the Gas Undertaking to the relief of rates, and Counsel tried to recall to Mr. Smith's mind certain negotiations between the Corporation and the Urban District Council in this connection.

Mr. ABADY interpolated the admission that throughout the Corporation's negotiations with the Urban District Council, the representatives of the former had said they did not think it would be possible to charge enough to enable that to be done.

Mr. *Smith* added that he did not think it was practicable in view of present-day competition.

Mr. HARKER said the Urban District Council had no objection

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to the Corporation being placed in a position that would enable them to balance their accounts. The risks which accompanied the conduct of a gas undertaking were the subject of much discussion. Mr. Harker suggested that there was not the slightest risk.

Mr. *Smith* pointed out that, for instance, low prices of electricity might undermine the gas business, and if Horwich obtained a supply of electricity the demand for gas would decrease.

Mr. HARKER, addressing the Committee on behalf of the Horwich Urban District Council, said that in view of the admissions made as to the policy of the Corporation in regard to the non-application of gas profits to the relief of rates, it would not be necessary for him to call evidence. This application was one of the most barefaced attempts to avoid the consequence of an Act of Parliament that it had ever been his privilege to hear put forward. Was it not obvious, from the evidence of Mr. Smith and from almost every word of Mr. Abady, that the Bolton Corporation had deliberately abstained from applying for an Order under section I. of the Gas Regulation Act? He had been a little puzzled as to why they should have abstained so deliberately; but the reason appeared to be that, though they were under an obligation to supply gas of a calorific value of 500 B.Th.U. per c.ft., they had not done so. Had they applied for an Order under section I. of the Gas Regulation Act, the fact that they had ignored the provisions of their Order of 1917, relating to the calorific value of the gas to be supplied, would have become apparent, and the Board of Trade would have had an opportunity of compelling them to act lawfully. There might also have been another reason—namely, that the Horwich Urban District Council could have challenged an Order under section I. The Corporation had been perfectly content with their low maximum price right up to the time when they had received the draft of the Act of 1929. Until then, the great fear that the price of coal and that other items of expenditure might increase had not occurred to them. If the Corporation had supplied a 500 B.Th.U. gas, the cost of manufacture might have been greater than the cost of making a 450 B.Th.U. gas, but that would have been taken into consideration if they had applied for an Order under section I. of the Gas Regulation Act, as he suggested they should have done. They had said that they were going to continue to break the law and to supply a 450 B.Th.U. gas. Therefore, the suggestion that the maximum price should be increased by 6d., in respect of the increased cost of supplying a 500 instead of a 450 B.Th.U. gas, should be ignored. Was this not an ordinary case, and should the Director do anything more than apply the ordinary principles applied in arriving at a fair maximum price? If it was felt that there should be an increase of the maximum price, based on the possibilities of an increase of the price of coal, Mr. Harker suggested that the outside figure should be 2d. per 1000 c.ft. In this calculation he would ignore possibilities of decreased costs resulting from economies in working. Then, with regard to the supposed loss of £10,000 in 1928-29, inasmuch as £6400 was spent for capital purposes, the loss was reduced to £3600, and that represented about 0·6d., or (say) 0·75d. per 1000 c.ft. The cost of manufacture *plus* capital charges in 1928-29 was 35·8d. per 1000 c.ft., and if one added to that the 2d. in respect of possible increase in coal costs, and 0·75d. to make up for the loss incurred, the figure of cost was increased to 38·55d. per 1000 c.ft., or (say) 39d. This ignored, of course, any increase of cost that would be incurred if they fulfilled the obligation to supply 500 B.Th.U. gas.

Mr. RONCA said he supposed Counsel was not suggesting that under the Gas Undertakings Act they would have to supply 500 B.Th.U. gas. The price was to be converted to the 500 B.Th.U. basis, and the Corporation could declare the calorific value of the gas they would supply.

Mr. HARKER said the point was that the maximum price for 500 B.Th.U. gas was 4s., but the Corporation had been selling 450 B.Th.U. gas to some consumers at 4s. But if another 6d. were added to the figure of 39d. which he had computed, that figure would be increased to 45d., which was 3d. below the present maximum, and he submitted that the present maximum was ample.

In regard to the precedents for prohibiting the transfer of profits from municipal trading undertakings to relief of rates, he said that wherever Parliament had had the opportunity to do so, they had prevented the profits of water undertakings being so applied. It might be said that water was more a necessity than gas, but he urged that gas must be regarded as one of the necessities of life under existing social conditions. Apart from precedents, there was an overwhelming case to support the application that the right of the Bolton Corporation to apply gas profits to relief of rates should be abolished.

Mr. ABADY, on behalf of the Corporation, said that Mr. Harker, in arriving at the cost of gas, had left out the item of income-tax and revenue contribution, which amounted to 1·08d. per 1000 c.ft. He urged that it would be impossible to find an undertaking, whether municipal or company owned, which had not a substantial margin between cost of gas and maximum price. The Bolton Corporation, by having a maximum price of 4s., was subject to a hardship which was not to the benefit of the undertaking. If, however, the Board of Trade felt it could not remedy that hardship without restricting the free management of the Gas Department, the Corporation desired to withdraw their application.

Mr. RONCA asked if the Corporation would still desire to withdraw their application if the Board imposed a limit on the amounts which could be applied to relief of rates.

Mr. ABADY said they would like an opportunity to consider that; they wished to be in a position to withdraw the application if they wanted to.

The inquiry then closed.

GAS ACTS (1920 AND 1929) ORDERS.

SPECIAL ORDERS.

Grange and Cartmell District Gas and Water Works Company.

To increase the maximum price for gas; to convert the existing shares of the Company; to authorize the raising of additional capital; and for other purposes.

Stone Gas and Electricity Company, Ltd.

To authorize the Company to use scheduled land for gas purposes, to vary the standard price of gas in parts of the area, to modify the provisions with respect to the sliding-scale of dividends, and to confer other powers.

Woking District Gas Company.

To empower the Company to raise additional capital, and to make other provisions with regard to the undertaking.

SECTION 1.

Preston Gas Company.

The Company have applied to the Board of Trade under section 1 of the Gas Undertakings Act, 1929, for authority to borrow on mortgage of their undertaking or by the creation and issue of debenture stock a further sum of £180,000. The Board order that section 8 of the Preston Gas Order, 1925, shall be amended by the substitution therein of the words "ninety per cent. of the aggregate amount of the paid-up ordinary and preference capital of the Company for the time being and of any premiums paid in respect of any ordinary and preference capital of the Company," for the words "one-half of the amount of the capital which at the time of borrowing has been raised under the powers of the Preston Gas Acts and Orders, 1865 to 1925."

SECTION 6.

Lancaster Corporation.

The Corporation shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

Milford Haven Urban District Council.

The Council shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

Northwich Gas Company.

The Company shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

Port Talbot Corporation.

The Corporation shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

Rhyl Urban District Council.

The Council shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

Wantage Urban District Council.

The Council shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

DECLARATIONS OF CALORIFIC VALUE.

Birkenhead Corporation.—450 B.Th.U. (April 1, 1930.)
Darwen Corporation.—450 B.Th.U. (April 1, 1930.)
Llandudno Urban District Council.—440 B.Th.U. (April 1, 1930.)
Middleton Corporation.—460 B.Th.U. (April 1, 1930.)
Stourbridge Corporation.—450 B.Th.U. (April 1, 1930.)
Wallasey Corporation.—470 B.Th.U. (April 1, 1930.)
Wombwell Urban District Council.—450 B.Th.U. (April 1, 1930.)

MINISTRY OF HEALTH INQUIRY AT PLYMOUTH.

Sanction to Borrow for New Holder.

An inquiry was held by Mr. R. C. Cox, on behalf of the Ministry of Health, at Plymouth on Friday, Nov. 22, into an application of the Corporation for sanction to borrow £32,000 for the erection of a new gasholder in St. Leven Road. It was stated that the total amount was made up of £23,000 for the holder, £1000 for the excavations, and £6000 for the foundation.

Mr. *F. Blackburn*, the Gas Engineer, said that the existing holder was erected 23 years ago, and under present conditions they did not have one day's storage, while on Sundays they only had four hours' storage. His contention was that they ought to have a holder capacity for 54 hours, which the new holder would give them. The proposed work would take eighteen months to complete.

Replying to the Inspector, who asked whether the normal growth of the undertaking would enable it to be carried on for 4½ years without the provision of the new holder, Mr. Blackburn answered in the negative, though he said it might be possible to carry on for three years.

The Town Clerk informed the Inspector that the undertaking was a paying concern, and that the whole of the profits after building up the reserve went towards the reduction of the price of the gas.

SMOKE POLLUTION AND CANCER.

A Lecture on "The Causes of Cancer" was delivered by Prof. A. E. Boycott, D.M., F.R.S., at the Royal Society of Arts on Friday, Nov. 22—Sir William J. Collins, K.C.V.O., M.D., M.S., presiding.

The cause or causes of cancer, said Prof. Boycott, are, of course, not yet fully made out, but we now know enough of the conditions which lead up to the disease to enable us to feel that we are really making progress in solving the problem, and to stimulate us to take some practical steps to diminish the incidence of the disease.

Looking at the kinds of people in whom cancer occurs we find: (1) that it is practically confined to middle aged and old persons; (2) that there is no evidence that it is catching like an infectious disease; (3) that there is no evidence that, in man, a tendency to cancer is commonly inherited; (4) that it occurs more frequently in urban than in rural districts; and (5) that its appearance is often preceded by chronic irritation and injury of the part of the body in which cancer develops, as from smoking clay pipes, a jagged tooth, X-rays, gall stones, drinking liquids too hot, &c. The careful investigations of Mr. C. E. Green, the legal publisher in Edinburgh, led him to associate a high cancer death rate, in Scotland and in France, with the use of coal as fuel, and Dr. Scott's inquiries showed very clearly the connection between superficial injuries incurred in the shale-oil industry and the subsequent appearance of cancer. Recently, spinner's cancer in Lancashire has been recognized as due to the use of mineral oils for lubricating the machinery.

In various ways, therefore, we have grounds for suspecting the products of burned coal and substances connected with mineral oils whose mode of origin is unknown, but which may reasonably be supposed to be related to coal. This suspicion has been much strengthened by the discovery by Yamagiwa and Ichikawa that the repeated application of tar to animals causes cancer. Of all the irritants which have been tried experimentally, tar, soot, and preparations made from them have proved by far the most effective. Using mice, which are particularly prone to malignant disease, cancer may be produced in the great majority of animals by persistent tarring. A striking fact has been made out in these mice, that cancer hardly ever appears in less than three months from the beginning of the irritation, and it is generally necessary to go on for about six months (and even longer) to obtain a tumour. The natural span of life in the mouse is rather less than three years, to which six months bears the same proportion as some fifteen years in the life of man. This entirely corroborates human experience. Cancer appears in shale-oil workers and spinners only after many years exposure. Mice also show us that the irritation need not be continued. A few applications of active tar may lead to the appearance of a tumour several months later. Hence, in searching for the causes of cancer, we must examine what happened fifteen or twenty years ago, as well as the immediately preceding history of the patient.

As matters of practical hygiene we learn that we should avoid irritation in all forms, and the case against the products of burnt coal is so strong that it is evident that the smoke nuisance ought to be stopped without further delay.

The next Chadwick Lecture in London, and the last of the Seventeenth Annual Series, will be given by Mr. W. A. Robson, D.Ph., B.Sc., Barrister-at-Law, in the Inner Temple Hall on Tuesday, Dec. 3, at 8 p.m., on the subject of "Public Health Law and Administration introduced by the Local Government Act, 1929"—Sir William J. Collins presiding.

Further particulars of Chadwick Public Lectures may be obtained from the Secretary, Mrs. Aubrey Richardson, O.B.E., at the Offices of the Trust, 204, Abbey House, Westminster.

GAS FOR TRADE AND INDUSTRY.

Mr. H. D. Madden on the Advantages of Gaseous Fuel.

A recently published Engineering Supplement of the "Western Mail and South Wales News" contained much of interest to members of the gas industry. One section, however, was devoted entirely to gas, and under the title of "Gas for Trade and Industry" Mr. H. D. Madden, M.Inst.C.E., M.I.Mech.E. (Member of H.M. Fuel Research Board), gave an interesting account of the revolution in the use of fuel in works and factories.

This is a gaseous fuel age, commented Mr. Madden, for there has been a revolution from the use in industry of the solid fuel fire to the application of gas as a fuel, derived either as the result of the distillation of bituminous coals in the carbonizing process, or water gas produced from cokes as practised by some of the iron tube trades, or a combination of the two processes. Economic factors in industry have called for a fuel that can be instantly applied, and when in use controlled to any desired range of temperature, and as readily turned off. Town gas as a fuel fulfils these conditions, and nothing is more striking in the history of the gas industry than the growth of the use of gas in our factories and workshops.

Attention was drawn to the striking figures which indicate the progress in industrial uses of gas during the past few years.

ADVANTAGES OF GAS.

What are the causes of this development? asks Mr. Madden. Unquestionably the first is the manufacturers' imperative necessity to increase the efficiency of production in face of keen competition. The speed of operation, adaptability, and reliability of gaseous fuel, the saving of ground space, and healthier surroundings, were all factors that influenced the minds of industrial leaders when weighing up the pros and cons of the case against the continued use of raw coal with all its inherent disadvantages of dust, smoke, and ashes, combined with huge costly chimney stacks.

With modern types of gas-heated furnaces it is possible to produce within the working chamber either neutral, oxidizing, or reducing atmosphere, and this adaptability is valuable because of the multifarious requirements of the various trades which employ town gas for heat treatment purposes.

AHEAD OF ALL OTHER INDUSTRIES.

In the United States great progress is being made in the application of gaseous fuel for all classes of heat treatment, and a well-known business man there has placed the gas industry ahead of all other industries as offering the greatest opportunity for future development. According to this expert, there are to-day some 20,000 new uses for gas which were unknown fifteen years ago, while nearly one-half of the United States are using gas service—and this in a land where there is cheap electricity.

The article then went on to refer to some of the particular uses in industry where gas is the pre-eminent fuel, finally emphasizing the great importance of banishing the smoke pollution from our industrial centres, and so promoting a brighter and healthier land.

SOUTH SUBURBAN GAS COMPANY.

Annual Dinner of the Engineer's Staff.

The Annual Dinner of the Engineer's Staff of the South Suburban Gas Company was held at the Duke's Saloon, Holborn Restaurant, on Tuesday, Nov. 26.

Mr. J. TERRACE, the Chief Engineer of the Company, presided, and 34 members of the staff were present. Mr. Terrace duly welcomed Mr. J. A. Brentnall, the Engineer of the Northfleet Works, and Mr. G. Jones, Draughtsman at Lower Sydenham, two new members of the Engineer's Staff.

The Loyal Toast was proposed by the Chairman, after which the toast of the South Suburban Gas Company was submitted by Mr. F. G. Gorman, Deputy Engineer, and was supported by Mr. W. N. Judd, of Bromley, Mr. R. J. Rix, of Sydenham, and Mr. C. E. Cross, of Crayford.

The toast to the Engineer's Staff was proposed by Mr. A. V. Hendrickson, Chief Chemist, and supported by Mr. Brentnall, of Northfleet, Mr. E. G. Dickinson, of Sydenham, Mr. J. H. Goldsmith, of Sydenham, and Mr. J. A. Rudling, of Belvedere.

The toast to the ladies was proposed by Mr. A. S. G. Harding, of Sydenham, seconded by Mr. W. Mackie, of Bromley, and supported by Messrs. E. W. Geary and K. D. Genge, of Sydenham.

"The Chairman" was proposed by Mr. W. Gosling, of Crays, and was supported by Mr. B. P. Bezant, Engineer of the Dartford Works. Mr. Terrace duly responded.

During the evening, the members of the staff were entertained by Miss Gwen Lewis and Mr. Lionel King.

The singing of "Auld Lang Syne" brought a very successful evening to a close.

NEW SHOWROOMS OPENED AT BANGOR.

Progress of the Undertaking.

Well-equipped showrooms and offices in connection with the Gas Undertaking at Bangor (Co. Down) have just been formally opened.

At the ceremony, Councillor Frederick J. Brice (Chairman of the Gas Committee) said that in Bangor, gas was the second cheapest in Ireland, and the Committee were hoping in the near future to make a reduction. He recalled that in the year 1883 the then Town Commissioners purchased the gas-works from the Bangor Gaslight Company for the sum of £750, and at that time there were 121 consumers. At present the gas-works' commercial value was approximately £200,000. Consumers numbered 4400, and the output for 1929 was 198,206,000 c.ft. The consumption for that year (1883) —1,194,000 c.ft.—would be about equal to 1¼ days' supply at the present time. The first vertical retort system was installed in 1914, the amount of gas then being made being 51,847,000 c.ft. a year. The number of cooking stoves on hire was then 546; to-day the figure was 2639. He concluded with a warm tribute to Mr. Barker Mitchell, Gas Engineer and Manager; Mr. Wm. Scotland, Assistant Manager; and Mr. W. H. Keenan, Clerk to the Undertaking.

Mr. Joseph Gillespie, the contractor, presented a gold key to Councillor Brice as a memento.

MACCLESFIELD GAS DEPARTMENT.

Report for the Year Ended March 31 Last.

There has been an increase in the consumption of gas amounting to 51,130 therms, which is 3·64 p.ct. above last year's figures. The prepayment system now amounts to 46·25 p.ct. of the whole consumption, and shows an increase of 3·48 p.ct. above last year's consumption. The total quantity of gas sold during the year was 1,454,500 therms. The average price received for all gas supplied amounts to 6·69d. per therm. The total amount of gas made was 1,580,057 therms; and the unaccounted-for gas was 7·07 p.ct. The maximum and minimum deliveries of gas during 24 hours were 6686 therms and 1621 therms respectively.

The number of cookers, gas fires, radiators, boilers, &c., sold or let out on hire purchase during the year was 648, against 510 last year. During the year 271 new service pipes were laid, and 271 new meters fixed; the total number of meters in use at the end of the year being 10,519—an increase of 108 on the previous year.

The capital account (total amount expended) now stands at £121,500, and the gas-works debt, after deducting the amount standing to the credit of the sinking fund, is £30,167.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

Markets are steady on the whole, and, with a good supply of tonnage and contracts to complete before the end of the year, prospects are satisfactory. Steam coals are still the outstanding feature, and strength in these extends into the early months of next year. There is no great pressure for gas coals, but a good average demand is keeping the position fairly steady, with good seconds rather better.

Wear Special gas makes quote 17s. 6d. f.o.b., with business passing at 17s. 3d. Best qualities (Holmside, Boldon class) quote 16s. 6d. to 16s. 9d., and seconds are 15s. 3d. to 15s. 6d. Demand for coking coals has improved, and best makes ask 16s., with ordinary qualities at 15s. 3d. to 15s. 6d. Best Durham bunkers are firm at 15s. 9d. to 16s., and seconds quote 14s. 6d. to 14s. 9d. Best Northumberland screened steams easily maintain 17s. f.o.b. for such odd lots as are available for sale.

Gas coke is nominally 25s. to 26s. f.o.b. for shipment, but supplies offering are too limited to test the market.

YORKSHIRE AND LANCASHIRE.

The general outlook continues good. Best hards on export account continue in request, and the output is practically fully taken. A substantial tonnage of secondary sorts is still on offer. There is a better request for gas coal. In the industrial fuel trade business is active, and washed smalls and singles are in better demand. The improved request for furnace coke continues, and quotations are stronger. The inquiry for house coal is not as good as would be expected at this time of the year.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports:

South Yorkshire.—Hards, Association, bunkers 19s. 3d. to 19s. 9d., export 18s. 3d. to 18s. 9d.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 18s. to 18s. 6d.; washed doubles, bunkers 18s. 6d., export 17s. 6d. to 18s.; washed singles, export 15s. 9d. to 16s. 3d.; washed smalls (steam), bunkers 15s. 3d. to 15s. 9d., export 14s. 3d. to 14s. 9d.; washed smalls (coking), export 14s. 9d. to 15s. 3d.; rough slack, bunkers 13s. 6d. to 13s. 9d., export 12s. 6d. to 13s.; smithy peas, export 18s. 6d. to 19s. 6d.

West Yorkshire.—Hartley's (f.o.b. Goole), bunkers 17s. 9d., export 17s. to 18s.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 17s. 6d. to 18s.; washed doubles, export 16s. to 17s.; washed singles, export 15s. 6d. to 16s.; washed smalls, bunkers 14s. 3d. to 14s. 9d., export 13s. 6d.; unwashed trebles, export 17s. to 17s. 9d.; unwashed doubles, export 15s. to 16s.; rough slack, bunkers 13s. 3d., export 11s. 6d. to 12s.; fine slack, export 9s. 6d. to 10s.; coking smalls, export 11s. 6d. to 12s.

Derbyshire and Nottinghamshire.—Top hards, bunkers 19s. 3d. to 19s. 9d., export 18s. 6d. to 19s.; cobbles, export 17s. 6d. to 18s. 6d.; washed trebles, export 17s. 9d. to 18s.; washed doubles, bunkers 18s. 3d., export 17s. to 17s. 6d.; washed singles, export 16s. to 16s. 6d.; washed smalls, bunkers 15s. 3d. to 15s. 6d., export 14s. to 14s. 6d.; unwashed doubles, export 16s.; rough slack, bunkers 13s. to 14s., export 12s. to 12s. 6d.; fine slack, export 9s. 6d. to 10s.

Yorkshire, Derbyshire, and Nottinghamshire.—Screened steam coal, bunkers 17s. to 18s.; export 16s. 6d. to 17s.; gas coke, export 25s. to 26s.; furnace coke, export 24s. to 24s. 6d.; washed steam, Goole (West Yorkshire), bunkers 17s. 3d.; Hull (West Yorkshire), bunkers 17s. 6d.; Hull (South Yorkshire), bunkers 17s. 9d., export 17s. per ton.

MIDLANDS.

Notwithstanding the open weather, collieries which have large connections with the London market and those of other Southern areas are confident as to the general enforcement of the December advance on house coals, averaging 1s. per ton. In this district the position is less assured. Keen competition between controlled and uncontrolled pits makes it very difficult to lay down a uniform policy.

Concerns outside the Five Counties Scheme are as anxious as those inside to put prices on an economic basis, however, and with Christmas approaching many private consumers are replenishing their reserves. The weak feature is that while stocks laid down at summer prices have been cleared, or nearly so, stocks at colliery sidings have been mounting up. It is only because consumptive demand has been so sluggish in nearly all departments that transport troubles have been escaped.

General industrial supplies are so plentiful that values show little change. Stringency is again accentuated with regard to coke. Blast-furnace men are asked to pay 19s., and there are threats of furnaces being stopped because of the irreconcilability of production costs and selling prices.

TRADE NOTES.

Sentinel Waggon Works Orders.

Among the many orders received recently by the Sentinel Waggon Works, Ltd., of Shrewsbury, for their well-known "Super-Sentinel" steam vehicles was a repeat order from the Shotley Bridge Gas Company.

New Gasholder for Llandudno.

The Llandudno Urban Council have accepted the tender of Messrs. Clayton, Son, & Co., of Leeds, for the erection of a new gasholder of one million c.ft. capacity in accordance with the specification of the Gas Engineer. The Council also accepted the tender of Messrs. Thomas Vale & Son, of Stourport, for the provision of two complete additional settings of horizontal retorts with all necessary steelwork. It was stated at a Council meeting that the total expenditure at the gas-works, including contingencies, would be £35,818.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec. 2.*

There has been no change in the prices of tar products during the past week.

Creosote for export is 6¼d. per gallon f.o.b.

Pitch is still 47s. 6d. per ton f.o.b.

As regards white spirits, pure toluole remains at 2s. 4d. per gallon; 95/160 solvent naphtha at about 1s. 5d.; pure benzole at about 1s. 11d.; and pyridine bases, 3s. 9d. to 4s. per gallon.

Tar Products in the Provinces.

Dec. 2.

There is no alteration in the markets for tar products.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s. Pitch—East Coast, 47s. 6d. f.o.b. West Coast—(f.a.s.) Manchester, 42s. to 42s. 6d.; Liverpool, 45s. 6d. to 46s. 6d.; Clyde, 45s. 6d. to 46s. 6d. Toluole, naked, North, 1s. 7½d. to 1s. 8½d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid and salty, 3½d. to 3⅝d.; low gravity, 2d. to 2¼d.; Scotland, 3½d. to 3⅝d. Heavy oils, in bulk, North, 5½d. to 6d. Carbolic acid, 60's, 2s. 5½d. to 2s. 6½d. prompt. Naphthalene, £12 to £14. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Tar Products in Scotland.

GLASGOW, *Nov. 30.*

There is no material alteration to report in the position of tar products in Scotland during the week. The market is quiet; but there is a feeling of optimism among producers, and already some large orders have been placed for forward delivery. Refined tar is firm, and pitch is consequently commanding good prices. The stocks of both are low in this area.

Pitch.—Stocks being low, prices have advanced to about 47s. 6d. to 50s. per ton f.a.s. Glasgow.

Tar is very steady at 3⅝d. to 4⅛d. per gallon *ex* works in buyers' packages.

Creosote.—There has been a further fall in prices. B.E.S.A. specification is 4d. to 4⅛d. per gallon; light oils, 3¼d. to 3⅜d. per gallon; neutral oil, 3d. to 3¼d. per gallon, all free on rails in buyers' packages.

Cresylic.—The market is still short of prompt supplies of low boiling grades; but prices are unaltered. 97/99 p.ct. pale is 1s. 10d. to 1s. 11d. per gallon; 97/99 p.ct. dark, 1s. 9d. to 1s. 10d. per gallon; 99/100 p.ct. pale, 2s. 2d. to 2s. 3d. per gallon; high boiling, 2s. to 2s. 1d. per gallon.

Crude naphtha is 6d. to 6¼d. per gallon, rails works.

Solvent naphtha is unchanged. 90/160 is 1s. 1¼d. to 1s. 2d. per gallon; 90/190, 1s. 0¼d. to 1s. 1d. per gallon.

Motor Benzole.—There is a steady demand at 1s. 5¼d. to 1s. 6d. per gallon.

Pyridine is unchanged at 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole	0 10	to 0 11	per gallon at works
Motor ,,	1 5	,, 1 6	,, ,, ,,
90 p.ct. ,,	1 7	,, 1 8	,, ,, ,,
Pure ,,	1 10	,, 1 11	,, ,, ,,

CONTRACTS OPEN.

Gas Oil.

The Bexhill Corporation Gas Department invite tenders for the supply of gas oil. [See advert. on p. 672.]

Pipes.

The Bexhill Corporation Gas Department invite tenders for the supply of cast-iron pipes. [See advert. on p. 672.]

Erection of New Carbonization Plant at Erith.

The Directors of Continuous Coal Carbonization, in a progress report to shareholders, state that supplementary patents have been filed, dealing with detailed mechanical perfections of the Company's continuous automatic process. Dense, hard, and smokeless briquettes have been produced of excellent quality at Erith and Birmingham, and have gained the approval of independent opinion. The automatic plant enables the oils to be removed at the temperatures at which they are evolved, thus preventing decomposition. The Directors have negotiated favourable financial re-arrangements and terms with the Incandescent Heat Company, and have now completed negotiations which will enable the Company to proceed with the erection of the new plant at Erith, which should be in full operation at an early date.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend	Dividends, Prev. Hf.Yr	Dividends, Last Hf. Yr.	NAME.	Quotations. Nov. 29.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Aug 15	6	6	Aldershot 5 p.c. max. C.	70—75	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref.	71—74	..	..
1,551,868	,,	Sept. 26	7½	7½	Alliance & Dublin Ord.	96—99	..	..
874,000	,,	July 11	4	4	Do. 4 p.c. Deb.	62—65	..	..
522,655	,,	Aug. 29	7	7	Barnet Ord. 7 p.c.	112—115	..	..
200,000	1	Oct. 24	1/4½	1/4½	Bombay, Ltd.	16/—18/-	..	..
172,500	10	Aug. 29	8½	9	Bournemouth 5 p.c.	12⅝—13½	..	..
500,050	10	,,	7	7	Do. B 7 p.c.	12⅝—12½	..	12½
439,150	10	,,	6	6	Do. Pref. 6 p.c.	10½—11	..	..
50,000	Stk.	July 11	3	3	Do. 3 p.c. Deb.	54—57	..	..
163,025	,,	,,	4	4	Do. 4 p.c. Deb.	72—75	..	..
367,900	,,	Aug. 29	7½	7½	Brighton & Hove 6 p.c. Con.	113—116	..	115
271,880	,,	,,	6⅔	6⅔	Do. 5 p.c. Con.	100—103	..	..
1,327,500	,,	July 25	5	5	Bristol 5 p.c. max.	87—89a	..	..
885,006	,,	Sept. 12	7½	7	British Ord.	115—118	..	..
100,000	,,	June 27	7	7	Do. 7 p.c. Pref.	112—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	71—74	..	..
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	94—97	..	..
100,000	10	May 30	8	8	Cape Town, Ltd.	9—10	..	..
100,000	10	Nov. 7	4½	4½	Do. 4½ p.c. Pref.	8½—7½*	..	..
150,000	Stk.	June 27	4½	4½	Do. 4½ p.c. Deb.	71—76	..	..
626,850	,,	July 25	8	8	Cardiff Con. Ord.	98—101	..	..
927,860	,,	June 27	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
187,150	,,	Aug. 15	6½	5	Chester 5 p.c. Ord.	87—92b	..	..
98,936	1	Oct 10	12/-	12/-	Colombo Ltd. Ord.	34/—36/-	..	..
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	19/—21/-	..	..
276,402	1	Oct. 10	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	28/6—25/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,078,280	Stk.	July 25	7	6	Commercial Ord.	90—95	..	91—93
475,000	,,	June 13	3	3	Do. 3 p.c. Deb.	55—58	..	55
787,550	,,	Aug. 15	7	7	Croydon sliding scale	105—108	..	105—106
499,100	,,	,,	5	5	Do. max. Div.	80—85	+3	..
542,270	,,	Aug. 29	10	7	Derby Con.	118—121e	..	..
65,000	,,	June 27	4	4	Do. Deb.	68—71e	..	..
200,000	,,	Aug. 29	5	5	East Hull Ord. 5 p.c.	73—76	..	..
1,002,180	10	Sept. 12	†7	†4	European, Ltd.	12½—14½	..	12½—14½
19,703,480	Stk.	July 25	5⅔	5⅔	Gas Light & Coke 4 p.c. Ord.	17/6—18/6f	..	18/—18/4½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	60—62	..	60½—62
4,167,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	72—75	..	74—75
3,603,620	,,	June 13	3	3	Do. 3 p.c. Con. Deb.	56—59	..	57—57½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	97—100	..	98⅔—99½
63,500	,,	Aug. 29	7	7	Hastings & St L. 5 p.c. Conv	98—103	..	..
388,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	77—82	..	..
70,000	10	Oct. 10	†10	†10	Hongkong & China, Ltd.	13½—14½	..	..
219,800	Stk.	Aug. 29	6	6½	Hornsey Con. 3½ p.c.	84—87	..	..
1,976,000	,,	Nov. 21	20	10	Imperial Continental Cap.	325—345*	—5	326—348
229,180	,,	Aug. 15	8½	8½	Do. 8½ p.c. Red. Deb.	71—76	..	..
235,242	,,	Aug. 15	7½	8	Lea Bridge 6 p.c. Ord.	115—118	..	..
3,145,807	,,	Aug. 15	6½	6	Liverpool 5 p.c. Ord.	93—93b	—½	..
600,600	,,	Sept. 26	7	7	Do. 7 p.c. Red. Pref.	100½—102½b	..	..
165,736	,,	Aug. 29	8	8	Maidstone 5 p.c. Cap.	122—127	..	..
69,486	,,	June 27	3	3	Do. 3 p.c. Deb.	53—56	..	..
75,000	5	June 13	†8	†10	Malta & Mediterranean	5½—6	..	..
392,000	—	Oct. 1	5½	5½	Metrop'tn (of Melbourne) 5½ p.c. Red. Deb.	93—95	..	..
641,820	Stk.	Nov. 21	†9	†6	Montevideo, Ltd.	103—106*	..	..
3,061,818	,,	July 25	5⅔	6	Newcastle & Gateshead Con.	16/—16/6d f	—/3	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	71⅞—72¼d	..	..
891,705	,,	June 27	8½	8½	Do. 8½ p.c. Deb.	66½—67½d	..	..
181,780	,,	Aug. 29	7/1/0	7½	North Middlesex 6 p.c. Con.	112—117	..	..
396,160	,,	Aug. 15	5	5	Northampton 5 p.c. max.	76—79	..	..
800,000	,,	Nov. 21	7	9	Oriental, Ltd.	108—113*	..	112—112½
205,162	,,	June 27	8	8	Plym'th & Ston'house 5 p.c.	110—113	..	..
424,416	,,	Aug. 29	8½	8	Portsm'th Con. Stk. 4p.c. Std.	113—118	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	80—83	..	..
2,334,464	1	June 27	—	†6	Primitiva Ord.	28/—31/-	..	..
244,500	100	June 8	4	4	Do. 4 p.c. Red. Deb.	92—95	..	..
695,000	Stk.	July 25	4	4	Do. 4 p.c. Red. Deb. 1911	79—82	..	..
416,345	,,	June 27	4	4	Do. 4 p.c. Cons. Deb.	79—82	..	80½—81
150,000	10	Sept. 26	6	6	San Paulo 6 p.c. Pref.	8½—9	..	..
1,786,968	Stk.	Aug. 29	6⅔	6½	Sheffield Cons.	104—106e	—1	..
95,000	,,	July 11	4	4	Do. 4 p.c. Deb.	75—77e	..	..
90,000	10	June 13	‡4	‡4	South African	4—6	..	4⅞—5
6,909,895	Stk.	July 26	7½	5	South Met. Ord.	99—101	..	99⅞—101
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	106—109	..	107½
1,895,445	,,	July 11	3	3	Do. 3 p.c. Deb.	54—57	..	..
784,000	,,	Sept. 12	6½	6½	Do. 6½ p.c. Red. Db.	98—100	..	..
91,500	,,	Aug. 15	8½	8½	South Shields Con.	109—111d	..	..
1,549,795	,,	July 25	6½	6½	South Suburban Ord. 5 p.c.	101—104	..	102
468,837	,,	June 27	5	5	Do. 5 p.c. Deb.	94—97	..	..
847,740	,,	Aug. 15	5	5	South'mpton Ord. 5 p.c. max.	77—80	..	..
191,275	,,	June 27	4	4	Do. 4 p.c. Deb.	70—73	..	..
179,014	,,	July 25	8	8	Sutton Ord.	116—119	..	..
67,828	,,	June 27	5	5	Do. 5 p.c. Deb.	90—93	..	..
360,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
200,000	,,	June 27	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
1,002,275	,,	Aug. 15	6⅔	6½	Tottenham District Ord.	101—106	..	..
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
181,255	,,	June 13	4	4	Do. 4 p.c. Deb.	74—77	..	..
389,094	,,	Aug. 29	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	97—102	..	..
88,880	,,	,,	5	5	Do. 5 p.c. pref.	85—50	..	..
80,000	,,	July 11	9	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	135—140	..	..
955,636	,,	,,	7½	7½	Do. B 8½ p.c.	112—117	..	..
482,535	,,	,,	6⅔	6⅔	Do. C and New	95—100	..	96
352,000	,,	,,	7½	7½	Do. Wimbledon 5 p.c.	105—110	..	..
99,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	113—118	..	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	87—93	..	..
88,416	,,	June 27	3	3	Do. 3 p.c. Deb.	54—57	..	..
284,743	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
207,500	,,	,,	5	5	Do. 5 p.c. Deb.	93—96	..	..

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. f.—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

Governor-General

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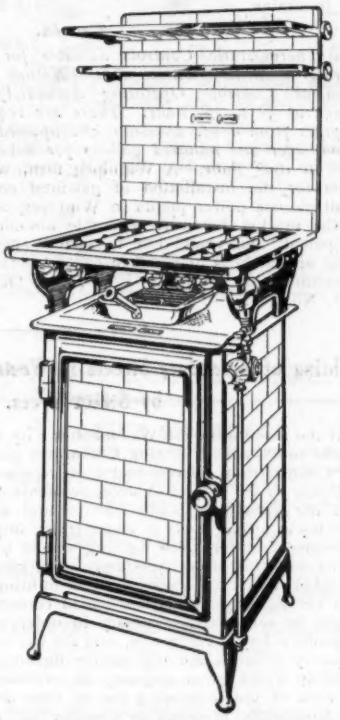

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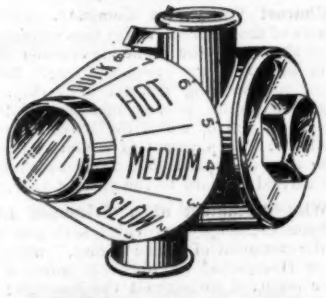

GENERAL GAS APPLIANCES LIMITED

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[From the Board of Trade Journal.]

Egypt.

Water Mains.—The Commercial Secretary at Cairo reports that the Ministry of the Interior is calling for tenders, to be presented in Cairo by Jan. 7, 1930, for the supply and installation of a system of water mains for the town of Luxor (Upper Egypt). The principal materials required are 10,850 metres of steel tubes of various sizes from 80 mm. to 300 mm. internal diameter, together with specials, 58 sluice valves, 15 hydrants, 7 column hydrants, and 6 drinking fountains.

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Lighting of Secondary Streets in Westminster and Obstruction by Street Trees.

At the meeting of the Westminster City Council last Thursday, the Traffic and Public Lighting Committee presented a report informing the Council that a letter had been received from the Commissioner of Police on the subject of street accidents in London, and mentioning that the growth of traffic had created an increasing tendency for vehicles to utilize roads of lesser traffic importance. In certain cases it seemed that improved lighting should be provided. The Commissioner said that street trees were sometimes allowed to grow to such an extent that they obscured street lighting. He expressed the hope that the lighting authorities would consider any improvements that might be considered necessary in order to assist in the promotion of public safety. There was, said the Committee, a somewhat marked disparity between the high-power lighting in main streets and the lighting of the great majority of secondary streets in Westminster. In view of the increasing use of these streets for traffic purposes, the Committee proposed to consider the matter in connection with the preparation of their next financial estimates. The question of improved lighting in secondary streets was raised at the last Council meeting. As to street trees, in Westminster they were continually under observation with a view to public safety and the prevention of obstruction to lighting. The Council resolved to inform the Commissioner that the matters referred to in his letter were receiving the City Council's attention.

Price Revisions at Swadlincote.—With a view to encouraging the use of gas for heating and cooking purposes, the Swadlincote Urban Council have decided to revise the prices charged for gas, based upon quarterly instead of annual consumption; the reduction to apply to the current quarter's credit accounts and to slot meter collections.

United Gas Industry.—Registered as a public company on Nov. 26, United Gas Industries, Ltd., has been formed with a nominal capital of £1,300,000, in 550,000 preference and 685,000 ordinary shares of £1 each, and 1,300,000 deferred shares of 1s. each. The Company will acquire and amalgamate the undertakings of Willey and Co. (including their interests in the Sutherland Meter Company and their gas undertakings, and the share capital of the Vulcan Stove Company), J. H. Robinson and Co. (Liverpool), and Smith Meters, Ltd., and carry on the business of gas, electrical, hydraulic, sanitary, and general engineers, &c.

Churnet Valley Gas Company.—The report and statement of accounts of the Churnet Valley Gas Company for the year ended Sept. 30 last show that the profit on revenue account is £1094, to which has to be added the amount brought forward from the preceding year—£709—making a total of £1803. Against this has to be charged debenture interest and bank interest, leaving for disposal the sum of £1439, which the Directors recommend shall be applied as follows: The payment of a dividend for the year ended Sept. 30 at the rate of 5 p.ct. (*less* tax), which leaves an amount of £639 to be carried forward to the current year.

Wise Precaution of a Telephone Exchange.—Fortunately the telephone exchange is provided with gas as well as electric lighting, was the comment of "The Times," when recording a failure of current at Hampstead for about 40 minutes last Friday evening. The failure occurred throughout the borough; and the cause is believed to have been an explosion and the fusing of a trunk cable in Kilburn High Road. There was a similar failure a month ago; and the Borough Council are taking steps to provide additional trunk mains. Friday's failure occurred while shopping in the poorer parts of the borough was at its height. Hundreds of householders and tradesmen, imagining for the moment that the lights had failed only in their own establishments, attempted to ring up the Borough Electricity Department, with the result that the telephone exchange was for a time choked with calls.

Tenders for Rugby Stock Issue.—The tenders for the £17,500 6 p.ct. redeemable debenture stock which were offered by the Directors of this Company were opened on Nov. 26, and ranged from £103 down to the minimum of par, the average price obtained being £100 15s. 6d. per £100 of stock.

Weather Troubles in Devon.—During a gale which was experienced throughout the whole of Devon last week, some of the supports of the gasholder at Axminster gave way, with the result that there was a leakage of gas, and the supply was temporarily cut off. The gasholder at Uffculme also heeled over, and the town was without gas for lighting or cooking purposes. During the floods which rose so rapidly on Monday, Nov. 25, the furnace house of the gasworks at Newton Abbot was imperilled, and the fire brigade had to be requisitioned to pump away the water.

High-Temperature Smokeless Fuel.—Experiments in the use of smokeless fuel have been carried out by the Metropolitan Asylums Board, and an extension in the use of coke and gas for hospital heating is contemplated. In June of last year the Hospitals Committee of the Board accepted an offer from the London Coke Committee to instal, free of cost, as an experiment, four open "Metro" coke firegrates at the Park Hospital. In a report at the end of October, the Medical Officer stated that the tests had shown that with the open coke fires about 45 p.ct. less coke than coal had been consumed over the same period.

Bingley Urban District Council have given sanction to the Lighting Committee to make application to the West Riding County Council for the appointment of a gas examiner for the area supplied by the District Council.

It is reported that a gas explosion occurred on Nov. 25 at Essen, resulting in the collapse of several buildings. Many people were buried in the wreckage, and three dead and twelve seriously injured had, at the time of the statement, been extricated.

At Bolton on Nov. 21, several boys were reported for damaging street lamps by the improper use of air guns. It was stated that, on an average, the glass in 250 street lamps suffered each month through sheer wilfulness. Some 266 lamps were involved last month.

Fire broke out during the week ended Saturday, Nov. 16, in a store of some 7000 tons of coal at the Meadow Lane Gas-Works of the Leeds Corporation Gas Department, and at the time of the visit of the Yorkshire Junior Gas Association to the works on that day the staff were fighting the outbreak and workmen were moving coal. The fire, however, persisted, and on Tuesday, Nov. 19, the Leeds City Fire Brigade were called. The brigade poured water on to the coal from five jets and got the fire under control, but it continued to smoulder, and it was expected that members of the brigade would have to continue in attendance for a further day or two. On Wednesday the outbreak was subdued, but the staff at the works continued to move coal as far as practicable. The store, fortunately, is well isolated, and there was no danger at any period to any gas-works property or plant.

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Engineer's Office,
Gas Offices,
The Square,
Portsmouth.

RAILWAY SIDINGS.

RAILWAY Sidings—laid complete in new or second-hand Rails.
Enquiries to E. E. JEAVONS & CO., LTD., CONTRACTORS, TIPTON.

CONTRACTS OPEN.

BOROUGH OF BEXHILL.
(GAS DEPARTMENT.)

CAST IRON PIPES.

THE Corporation invite Tenders for the above, particulars of which may be obtained from Mr. L. G. Humphrys, A.M.I.Mech.E., Engineer and Manager, Gas Office, 5, Sea Road, Bexhill.

Tenders, sealed and endorsed "Tenders for Cast Iron Pipes," must be received by the undersigned on or before Noon on Wednesday, the 11th of December, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

S. J. TAYLOR,
Town Clerk.

Town Hall,
Bexhill-on-Sea,
Nov. 26, 1929.

BOROUGH OF BEXHILL.
(GAS DEPARTMENT.)

GAS OIL CONTRACT.

THE Corporation invite Tenders for the Supply of GAS OIL for a period of Twelve Months from the 1st of January, 1930.

Particulars may be obtained from Mr. L. G. Humphrys, A.M.I.Mech.E., Engineer and Manager, Gas Office, 5, Sea Road, Bexhill.

Tenders, sealed and endorsed "Tender for Gas Oil," must be received by the undersigned on or before Noon on Wednesday, the 11th of December, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

S. J. TAYLOR,
Town Clerk.

Town Hall,
Bexhill-on-Sea,
Nov. 26, 1929.

COMPANY NOTICE.

THE GAS LIGHT AND COKE COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCKS and MORTGAGE BONDS, WILL BE CLOSED at 4 o'clock p.m. on Tuesday, the 10th prox., for the half-year ending on the 31st prox., and will be RE-OPENED on the morning of Wednesday, the 11th prox.

The Interest for the half-year will be remitted by Warrant forwarded by post on the 31st of December next to the Proprietors registered on the Closing of the Books, or their authorized Agents.

By order,
WILLIAM LYLE GALBRAITH,
Secretary.

Chief Office,
Horseferry Road,
Westminster, S.W. 1,
Nov. 26, 1929.